

METRIC SYSTEM OF WEIGHTS AND MEASURES.

JUNE 20, 1898.—Referred to the House Calendar and ordered to be printed.

Mr. CHARLES W. STONE, from the Committee on Coinage, Weights, and Measures, submitted the following

REPORT.

[To accompany H. R. 1058.]

The Committee on Coinage, Weights, and Measures, to whom was referred the bill (H. R. 1058) to fix the standard of weights and measures by the adoption of the metric system of weights and measures, have duly considered the same and respectfully report as follows:

This bill is briefer and more concise than House bill 7251 of the Fifty-fourth Congress, but in effect is practically the same. That bill was carefully and thoroughly considered by this committee in the Fifty-fourth Congress, and was the subject of two somewhat elaborate reports, being Nos. 795 and 2885.

Those reports fully set forth the reasons which seem to render the adoption for general use of the metric system of weights and measures by the United States desirable and important, and your committee now reaffirm the views set forth in those reports and adopt them as a part hereof.

The present bill makes the use of the metric system obligatory on the Government of the United States in the conduct of the business of the Government. This is in accordance with the recommendation heretofore of the heads of most of the Executive Departments, and, it is believed, would speedily prove a matter of great economy and convenience in transacting the business of the Government.

To your committee the Hon. John A. Kasson, now representing the State Department in a special capacity, and who has had exceptional opportunities for observation, expressed himself strongly as to the annoyance and trouble encountered in his reciprocity negotiations growing out of our different system of weights and measures, in relation to which he stated as follows: "It is a continual embarrassment and annoyance, and very much trouble is going to be saved in all the Departments and to every citizen of the United States as soon as he can apply the decimal system." It is believed by your committee that the practical way to make the desired change, and with the least trouble and friction, is to make it first by the Government in its own business. The people will speedily follow the example thus set.

No compulsion on the individual citizen is attempted, and none will be needed. He may use his pounds, pints, and bushels, varying as they do in different localities and when applied to different commodities, if he chooses, but when the convenience of the metric denomina-

tions has had practical demonstration he will abandon the present system as completely as he did the shillings and pence in his currency.

When our decimal system of money was introduced there was no prohibition on the continued use of pounds, shillings, and pence, but the vastly superior convenience of the decimal system led gradually to its universal use without Government compulsion, and the decimal system is becoming gradually engrafted into the monetary systems of other nations.

Exactly the same reasons that make a decimal system of currency desirable make a decimal system of weights and measures equally desirable. The United States adopted its decimal system of currency for itself without any reference to the system of any other nation, merely as a matter of convenience for its own citizens. So, on grounds of home convenience and economy of time and effort, it may properly adopt a decimal system of weights and measures; but when to this consideration of domestic convenience and economy is added the fact that the adoption of such system gives to us a common basis of business communication with nearly the whole world, and dispenses with the labor of translation from the terms of other countries into our own and from ours again into theirs, making at once intelligible the prices, statistics, and market reports of other nations, the consideration of economy and convenience is greatly increased.

We have a universal language of numbers in the Arabic numerals. Add to that a universal language of size, quantity, and length, and the business transactions and general communication of nation with nation are vastly simplified. Add again the adoption of a common denominator of value in the form of a universal or international coin, and the most serious of the artificial, unnatural, and unnecessary barriers to free international communication are broken down. These measures are entirely practical. The adoption of a common system of weights and measures is nearly accomplished. England, Russia, and the United States only remain wedded to their own systems. England has made the metric system fully permissive, and the demands of the commercial interests, which find themselves suffering in competition with metric-using nations, and of the laboring classes, who seem to realize the saving of time and labor to come from the adoption of a simpler system, are steadily pushing Great Britain toward the adoption of the decimal system. The Russian Government has the matter under consideration, and will follow if it does not precede Great Britain. Shall the United States hang laggard in the rear?

Thirty odd years ago Charles Sumner tersely and graphically stated the situation as follows:

A system of weights and measures born of philosophy rather than chance is what we now seek. To this end old systems must be abandoned. A chance system can not be universal. Science is universal; therefore what is produced by science may find a home everywhere.

We are to-day stepping across the threshold of a new national career. The world opens before us. The coming of the new century will find us grasping for the trade and commerce of the world. We are becoming an aggressive force in the affairs of the world. In this new career we will encounter jealous watchfulness and sharp competition. Should we not free ourselves from everything that hampers our activity in the great race? To secure the trade of the nations of the world we must bid for it in terms understood by them. We must carry into the struggle no load of antiquated systems and inconvenient and cumbersome methods.

Your committee believe that the adoption of the metric system of weights and measures would be an advantage and stimulus to our foreign commerce as well as a saving of time and labor in all the affairs of our domestic life, and they therefore recommend the passage of the bill herewith reported, changing only the word "system," in the tenth line, to the word "standard," to conform to the phraseology of the Constitution, which vests in Congress the power "to fix the standard of weights and measures."

[House Report No. 2885, Fifty-fourth Congress, second session.]

Mr. CHARLES W. STONE, from the Committee on Coinage, Weights, and Measures, submitted the following

REPORT.

[To accompany H. R. 7251.]

The Committee on Coinage, Weights, and Measures, to whom was recommitteed the bill (H. R. 7251) "to fix the standard of weights and measures by the adoption of the metric system of weights and measures," respectfully report that they have again carefully considered said bill and report it back to the House with the recommendation that it do pass with certain amendments hereinafter fully indicated.

In their former report the committee presented with some fullness and care the reasons which to them seemed to render the legislation proposed by this bill proper and desirable. They see no occasion to change in any way the views therein expressed. They therefore readopt that report, as in their judgment a fair presentation, historically and otherwise, of the general question involved in the bill, and proceed to a more particular reexamination of its provisions and to the statement of such facts bearing on the subject as have come to their knowledge since the former report was submitted.

The bill contains four sections. The first section provides that after July 1, 1898, the metric system of weights and measures shall be exclusively used in all the operations of the Government, except in completing the survey of the public lands. This system is already partially in use in several of the Departments, and in communications to your committee the Secretary of the Treasury, the Postmaster-General, and the Secretary of Agriculture have unequivocally recommended the adoption of the system. In the Interior Department it has seemed best to make an exception of the completion of the surveys of the public lands for the sake of uniformity, and to avoid confusion where exterior lines have already been run. No expression of opinion was asked or received from the other Departments. Former Secretaries of the Treasury have repeatedly urged the adoption of the metric system in whole or in part for governmental operations, and it is said that every Secretary of State for years, without exception, has left that Department strongly impressed with the importance of having this country brought into accord with other nations in the use of a common system of weights and measures.

The Government has already recognized the metric system as embodying the fundamental standards of weight and measure, and after such official recognition there is an inconsistency in continuing in its own operations the use of another system. Especially at the custom-houses, where imports come invoiced in this universal system, would there be saving to the Government in also making its own uniform. In the Post-Office Department every letter and piece of mail going out of or

coming into this country has its weight determined in grams. Why not weigh all mail matter in the same way and by the same scales?

The law prescribes the weight of the half dollar, quarter, and dime in grams. Why weigh the dollar in grains? All the operations of the Office of the Surgeon-General of the Navy involving weights and measures are expressed in metric terms; why not equally those of the Army?

The adoption of the metric system would not only bring us into accord with other nations, but produce at home, in the operations of our own Government, uniformity where now diversity and confusion exist.

It seems proper, however, to give adequate time to make the many preliminary arrangements for the change. For this by the experience of other nations and from the opinions of Government officials and others best qualified to express an opinion, it would seem that two years is ample time. Your committee, however, desire to have no question on this point and accordingly recommend that the first section of the bill be amended by striking out the words "eighteen hundred and ninety-eight," and substituting therefor "nineteen hundred," thus giving over three years for necessary preparations.

The second section of the bill provides that after January 1, 1901, the metric system of weights and measures shall be the only legal system of weights and measures recognized in the United States. This does not imply that any other system may not be used by any citizen who prefers to use it. It does not propose to make the use of the metric system compulsory on the people as has been done in many of the countries of Europe. It does not propose to prohibit or in any way interfere with the continued use of the now customary weights and measures by anybody desiring to continue their use. It purposes simply to establish certain legal standards to which reference can be made in case of dispute or for any proper purpose, and it proposes that these standards shall be the same that are recognized as authoritative by every nation of the civilized world with but two or three exceptions.

If question or dispute shall arise as to the accuracy of measurements or of the correctness of the instruments of such measurement, there should be somewhere a final, fundamental, legal standard by reference to which such questions should be settled, and this should be furnished and prescribed by the General Government, which is specifically vested with this power by the Constitution. This standard should be unchangeable and capable of accurate verification. As such standard for measurements of extension this country has already accepted and adopted by executive order the international standard meter; and to-day if the United States Government is called upon to determine the accuracy of any foot or yard measure it determines it not by comparison with any foot or yard measure in the custody of the Government, but by comparison with the international standard meter adopted and carefully preserved by the Government.

So, if any question arises as to weight or the accuracy of scales or instruments for determining weight, such questions on final appeal to the General Government are settled, not by any pound weight—troy, apothecaries' or avoirdupois—preserved by the Government, but by comparison with the standard international kilogram.

Questions of capacity and of the accuracy and correctness of measures of capacity, as of the quart, gallon, or bushel, are determined where an authoritative determination is asked of the General Government, not by reference to any quart, gallon, or bushel measure held by it, but by reference to the international standard liter.

All this is now done by executive order of the Secretary of the Treasury, in whose Department is the Bureau of Weights and Measures, of which the Superintendent of the Coast and Geodetic Survey is ex officio superintendent.

These "fundamental standards" furnished to the United States as a member of the International Bureau of Weights and Measures, were received by the President of the United States with considerable ceremony and are guarded with great care. They afford the only accurate and authoritative standards for final reference now available by the Government, and are the same as those recognized by Germany, Austria Hungary, Belgium, Brazil, Chile, Argentina, Denmark, Spain, France, Italy, Greece, Peru, Portugal, Roumania, Servia, Sweden and Norway, Switzerland, Turkey, Mexico, Colombia, Costa Rica, Ecuador, Guiana, Bolivia, Paraguay, Uruguay, and Venezuela, and in case of loss can be easily replaced by duplicate and equally accurate standards from the International Bureau of Weights and Measures. Their authoritative character in this country rests largely on executive action, based on the law of 1866.

It is submitted, however, that Congress, vested by the Constitution with power "to fix the standard of weights and measures," is the proper body to establish such "fundamental standards," and the second section of this bill is practically a ratification by the body properly possessing the power to act of the action already taken by the Secretary of the Treasury. It establishes authoritative standards of weights and measures never yet explicitly done during one hundred and twenty years of national existence. When that is done it is still optional with the people to use the denominations corresponding to those standards or not, but they exist for final and authoritative reference in any case where legal accuracy is necessary or desirable.

So the Government established a legal system of coins and currency denominations, but it forced nobody to use them. If the people preferred to use shillings and pounds or bits and pistareens they were at perfect liberty so to do, and in certain sections did continue to do so for a considerable time. Gradually, however, the vastly greater convenience of our decimal system came to be appreciated and its use became universal. So when once fairly and properly adopted by the Government the vastly greater convenience of a decimal system of weights and measures will come to be recognized by the people, its use will gradually extend, and the present heterogeneous, brain-racking, patience destroying system will pass out of use without serious friction, without compulsion, and without regret.

Your committee would leave no basis for the misapprehension that any compulsion is to be resorted to to secure the use of the metric system by the people, and hence they recommend that the word "only," in line 3 of section 2, be stricken out. They also recommend that the word "one" in the same line be stricken out and the word "three" inserted, which gives a liberal and probably unnecessarily long time for the people to acquaint themselves with the new system before it is made legally authoritative.

The third and fourth sections of the bill relate to matters of detail and are added by way of precaution that there may be no possible uncertainty as to the exact standards adopted and the equivalents therefor in terms of customary weights and measures to be used in case of conversion from one to another, and are in accord with existing facts and law.

Having given this explanation of the purpose and effect of the several

sections of the bill, your committee can not express too strongly their conviction of the merits of the measure or of the desirability of its being speedily placed on the statute books.

This conviction is reenforced by the many petitions that have been received in favor of the passage of the bill from all parts of the country, and by the expressions of opinion that have come alike from students and practical men of business, from college professors and operators of railroads, from engineers, architects, manufacturers, and men in all vocations. From the faculties of 27 colleges located in 16 different States have come petitions for it. State educational associations have forwarded resolutions of approval. The resolutions of the Association of American Agricultural Colleges are appended hereto. With them are also given the resolutions unanimously adopted by the Association of American Steel Manufacturers, the resolutions of the Philadelphia Engineers' Club, and other expressions of opinion. Perhaps no one of these is entitled to more consideration than that of the late president of the Pennsylvania Railroad Company, George B. Roberts, who has so recently passed from the cares and labors and responsibilities of this life. He was not a theorist, but essentially a practical man of affairs, of great experience, of wide knowledge, of clear apprehension, and of sound judgment, and his opinion should carry with it great weight. With the terseness and directness of a trained man of business he covers the whole situation in the following words:

I am heartily in accord with the efforts to establish a metric system of weights and measures for our country. It is only a want of knowledge on the part of the general public of what the adoption of such a system means, in simplifying everything that depends upon weights and measures in our country, that I am sure prevents the measure being more heartily seconded by the public. After it is once adopted it would be ten times more difficult to get the public to return to the present system than it is at present to get them to change to the metric.

This expression of opinion is in exact accord with the actual experience of those nations who have changed to the metric system and have it in actual daily use. The test of actual application and use is vastly more valuable than theory, speculation, or prediction. The apprehensions of those who see serious trouble in making the change should be entirely set at rest by the actual experience of those people who have made the change.

Your committee, desiring authoritative information on this and other points, requested that the State Department obtain, through our ministers to Germany, Austria-Hungary, and Norway-Sweden, information drawn from the actual experience of those nations on the following points, viz, (1) as to the ease or difficulty with which the change of systems was made and as to the manner of introduction of the metric system and the time occupied in making the change; (2) as to how far the metric system was satisfactory in practical operation, and whether there was any desire to return to former systems; and (3) as to what effect the adoption of the metric system has had on the commerce of the nations adopting it.

The Secretary of State promptly acceded to the request of the committee and the official replies to these inquiries are attached hereto.

They all substantially concur in the statement that the trouble and inconvenience in making the change was by no means serious; that no one of the nations has the least desire to return to the former system; and that the effect on the commerce of the nations adopting the system, so far as any opinion is expressed, has been plainly beneficial.

Such authoritative testimony ought to set at rest any apprehension of any serious trouble in making the change in this country.

Your committee have also been fortunate in obtaining through the late Prof. B. A. Gould, the representative of this country on the international bureau of weights and measures, an interesting statement from Professor Foerster, under whose official direction the change was made in Germany, and they append it to this report. In transmitting to the committee this report Professor Gould says:

The writer is the director of the observatory at Berlin and has from the beginning been the chief of the German (previously also of the Prussian) bureau of weights and measures, and has probably a more comprehensive knowledge of the whole subject than any other person. He is also at present the president of the international committee of weights and measures.

Your committee also append hereto letters from Isaac Mondschen, esq., of Cincinnati, and Arnold Schlaet, esq., both citizens of the United States, whose ability and character give weight to their testimony, who were residents of Germany when the change of systems was made, and who speak from actual personal observation and experience.

In connection with these communications your committee also desire to call attention to the report of George Sawter, consul at Glauchau, under date of September 12, 1896, and which appears in the December number of the Consular Reports, and which concludes as follows:

Naturally the almost cosmopolitan use of a system of weights and measures totally different from that employed in the United States places its merchants interested in foreign trade at a great disadvantage. Not only are American price lists confusing to the foreign merchants, owing to the different denominations used, but the fact that foreign lists are made in terms equally unfamiliar to American merchants is said to result in unfair discriminations and often in fraud.

In the judgment of your committee the adoption of the metric system by this country would materially aid our foreign commerce with metric-using nations. South American trade, especially, which should come here, is drifting more and more each year to Germany, which furnishes trade quotations in metric terms intelligible to the South American States. England appreciates and suffers from this tendency of metric-using nations to trade with each other, and is moving to place herself in touch with them. Russia clearly shows the same purpose, as is indicated by dispatches from our minister at St. Petersburg, appended hereto.

Action by the United States would unquestionably be followed promptly by both these nations, and then a common and universal system would prevail throughout the civilized world. In the language of Charles Sumner, who, in the chaotic days which succeeded our civil war, captivated the Senate by his scholarly and yet practical presentation of this subject:

The adoption of the metric system by the United States will go far to complete that circle by which this great improvement will be assured to mankind. Here is a new element of civilization which will be felt in all the concerns of life at home and abroad. It will be hardly less important than the Arabic numerals, by which the operations of arithmetic are rendered common to all nations. It will help undo that primeval confusion of which the Tower of Babel was the representative.

With more of British directness and particularity but less elegance of diction, the special committee of the House of Commons in an unanimous report sum up the conclusions they reach after a thorough investigation of this subject. They say:

Your committee think that no country, especially no commercial country, should fail to adopt a system which will save time and lessen labor; which will give to trade greater certainty in its operations, diminish the intermediate agency with which it is encumbered, render more exact machine making, engineering, and manufactures, and remove a number of arithmetical barriers, which stand, like obstructive toll bars, on the highway of education.

To any American who has had occasion to contrast the convenience and simplicity of our decimal system of money with the complicated, non-decimal system of England, the mere statement that the metric system is symmetrically decimal in character and that its use would bring to the daily transactions involving weight or measure the simplicity and convenience and economy in computation that pertains to our currency system is to state an argument conclusive on its face. Who would agree to substitute for our decimal currency one composed of farthings, pence, shillings, and pounds? Who doubts the immense superiority and economy of the decimal system? Why not apply it, then, to weights and measures as well as to money?

Different manufacturers and traders testified before the British committee in 1895 that the adoption of the metric system would so diminish the work of their clerks and bookkeepers as to enable them to dispense with the services of one or two men in each case. A single railroad company estimated that its saving would be \$50,000 per year.

When you remember that the metric system, besides being decimal in character, is nearly a universal system, and that its adoption by this country would bring to us not only the saving and convenience incident to its decimal character but would dispense with the labor of converting from the terms of one system to another the innumerable transactions and communications involving weight or measure between this country and all the twenty-nine metric-using nations of the world, you have an idea of the saving the adoption of this system would bring that is almost inconceivable from its immensity.

Add to all this the wasted time of every school child needlessly spent in struggling with the complicated tables of our present system and the problems involving them, and you have in a nation of 70,000,000 of people a vast aggregate of wasted time and energy fearful to contemplate. It has been said that the great problem of to-day in all departments of labor is the elimination of waste. All around us in the little affairs and great affairs of life thoughtful and conscientious men are struggling with that problem. Is there in any other single direction the opportunity to eliminate so great a waste of time and energy as by the substitution of a simple decimal system for our present complicated, heterogeneous, brain-wasting system?

Finally, your committee say that to be honest with the people and consistent with itself Congress should pass this measure. In practical effect it is simply a bill for the adoption by the Government of the metric system in its operations. It has been saying to the people in one way and another for thirty-odd years that this is a good system, better and more convenient than the one in use, and by furnishing standards to the States, and otherwise, has encouraged the use of it, but has neutralized the effect of all this by not itself using it except partially in its own operations.

The question is a natural one, if this is so good a system as to render proper the adoption by the Government of its standards as the "fundamental standards" of final resort, and if this Government can properly unite with other nations in an international bureau of weights and measures, one of whose purposes is to extend the use of the metric system, then why should it not use it in its own operations? If so great a saving would come from avoiding the conversions from the terms of one system to another, why should not the Government make this saving at its own custom-houses and in its other operations? If the Secretary of the Treasury and other responsible heads of Departments making the most use of weights and measures in Government

transactions recommend the adoption of this system, why should not their recommendation be followed?

Put the system in practical and uniform operation in the transactions of the Government and the adoption by the people will take care of itself. Its merits will be brought home to them in practical form, and knowledge will inevitably bring approval. No compulsion on the people is contemplated and none will be necessary. The system of the Government of the people will speedily and easily become the system of the people.

FROM THE UNITED STATES AMBASSADOR TO GERMANY.

DEPARTMENT OF STATE,
Washington, September 11, 1896.

SIR: Referring to your letter of the 11th of May last, asking this Department to obtain information as to the ease or difficulty with which the change was made to the metric system of weights and measures by Germany and certain other countries, I have the honor to inclose for your use a copy of a dispatch, No. 119, of the 21st ultimo from the American ambassador at Berlin on the subject.

I have the honor to be, sir, your obedient servant,

W. W. ROCKHILL, *Acting Secretary.*

Hon. CHARLES W. STONE,

*Chairman of the Committee on Coinage, Weights, and Measures,
House of Representatives.*

No. 119.]

EMBASSY OF THE UNITED STATES,
Berlin, August 21, 1896.

SIR: Referring to your instruction No. 52, May 18 last, I have the honor to inclose a copy, with translation, of a reply received to-day from the Imperial foreign office to my note, F. O. 39, May 28, 1896, in regard to the adoption of the metric system of weights and measures in Germany.

I have, etc.,

EDWIN F. UHL.

Hon. RICHARD OLNEY,

Secretary of State, Washington, D. C.

[Inclosure in dispatch No. 119.—Translation.]

Baron von Rotenhau to Mr. Uhl.

FOREIGN OFFICE, Berlin, August 20, 1896.

Referring to the note of May 28 last, the undersigned has the honor to transmit to his excellency the ambassador extraordinary and minister plenipotentiary of the United States of America, Mr. Uhl, a promemoria of the imperial "Normal-Aichungs-Kommission," regarding the introduction of the metric system in Germany, which gives the answers to the questions of the above note.

The undersigned avails himself, etc.,

ROTENHAU.

[Translation of the foregoing accompaniment.]

PROMEMORIA.

(a) Whether or not serious difficulty was encountered in making the change from the customary weights and measures to those of the metric system in Germany?

The introduction of the metric system dates so far back that it is difficult to give a positive answer which would be based on facts. It is natural that a measure which so deeply affected all commercial affairs and conditions of life, and whose object it was to replace the largest part, although not all, the weights, measures, etc., which were used in commercial trade, could not be effected without certain

difficulties; these difficulties have, however, as far as can be seen by the material accessible to the "Commission for marking weights and measures" (Normal-Aichungs-Kommission), been overcome with comparative ease. The opportune purchasing, examination and official stamping of the new measures in particular was attended to without objection, so that no mention of any serious difficulty can be made in this direction.

This new regulation naturally brought with it certain inconveniences, such as are unavoidable with reforms of the nature. Trades people, who were chiefly affected thereby, had, however, the advantage that for the time being they could make use of the more expensive utensils in their old form, such as scales and the larger weights, as the pound (zollpfund = $\frac{1}{2}$ kilogram), which was based on the metric system, was adopted a long time ago. The purchasing public, on the other hand, soon enough appreciated the manifest advantages of uniform measures and weights, which they had until then missed, and accepted the unavoidable irregularities and inconveniences, as it seemed, without any grave complaints.

(b) In what manner was the metric system introduced, and what time was occupied in making it?

These questions are answered by the regulations on measures and weights of August 17, 1868, and the regulations of their going into effect connected therewith.

The technical part of execution was placed with the newly founded "Normal-Aichungs Commission" (Normal-Aichungs Kommission) (article 18 of the regulations on measures and weights) which, after enforcement of the law, at once began its work. This commission had two matters to attend to. In the first place, it has to give detailed directions regarding the material, shape, specification, and other conditions of the measures and weights, which was done by the "marking" ordinance of July 16, 1869. The industries were thereby given an opportunity to begin with the manufacture of the new measures and weights and to complete the necessary amounts of the same until the date of their compulsory introduction. The Normal Marking Commission, in the second place, had to furnish the "marking" office with all implements necessary to carry on the marking, so that they would be in a position to mark and stamp all measures and weights presented to them. Aside from this, it was ordered that to make this change less difficult the calculations giving the figures of the measures, etc., heretofore in use as compared with the new be published by the confederated Governments.

The organization of the authorities (marking authorities) which were intrusted with the marking and stamping of measures, etc., was not effected by the Empire, but was left to the confederated Governments. For Prussia the law governing this subject of November 26, 1869 (Law Collection, p. 1165), has been adopted. A number of the other confederated States have adopted the Prussian arrangement in this matter as a model.

The measures and weight regulations went into force on January 1, 1872, about three and a half years after its publication. But it was allowed to make use of the new measures, etc., etc., as soon as January 1, 1870, whenever the parties interested agreed to do so. The above-stated time was sufficient to introduce the new system in all its completeness, especially to equip the marking offices with the necessary utensils and to manufacture a sufficient amount of measures, etc., and to mark them, as to enable their exclusive use by January 1, 1872. This is the more remarkable, as up to that time a very large number of different systems of measures were used in Germany.

2. How far the metric system is satisfactory in practical operation. Is there any desire or disposition to return to the former system?

Commercial trade has fully familiarized itself with the new measures, and they have proven themselves to fully answer the purpose. In a large degree, it is true, the population still cling to the old system of measures. This is particularly the case with measurements of lengths and square measurements, as the meter, with its many divisions, and the "ar" and "hectar" could not thus far displace the old measures (fecht, niches, "elle," "ruthe," "morgen"). But this has also been observed in other departments, for instance, in the currency system; and which was also demonstrated in other States, for instance, in France, where, after the metric system had been introduced, it was found necessary, after forty years, to threaten with punishment advertisements under the old measures.

The earnest desire to return to the old system will hardly be found to exist any where in Germany. A measure of this kind could not be adopted for the reason that, as stated above, before the introduction of the metric system a large number of systems, in many instances varying from each other, were used in the individual German states, and that among these systems none could be found which had such great advantages as compared with the others as the metric system, so as to adopt it in place of the latter. The main consideration is that none of the old systems fully belonged to the decimal system. But the advantages connected with the decimal system are so important that, for this reason alone, a return to a former system would not be seriously considered.

3. What effect, if any, has the adoption of the metric system had on trade and commerce of Germany?

The Normal Marking Commission is not in a position to answer this question; it is without the necessary data, which could only be obtained upon inquiry from the more important unions of trade and commerce. It will, furthermore, be difficult to prove a direct influence of the metric system on German trade and commerce, and to try to base it on statistics. That the removal of the former manifold German measures and weight systems and the introduction of a uniform measure throughout Germany has been advantageous to trade and commerce will hardly need to be proven. This measure belongs to one of the many factors which in connection with political changes have added to the commercial development during the last thirty years. But that the influence which might be placed to the credit of changing the measures and weights system is exclusively or mainly due to the metric system could hardly be proven. Nevertheless it may be said that the clearness of this system, especially the decimal system prevailing throughout, and the simple denominations existing between the measures of lengths, capacity, and weights carries with it such advantages, as it simplifies all calculations on measures and weights.

Furthermore, it must be remembered that the adoption of this system brought advantage to international commerce, as at that time it was already introduced in a large number of foreign states, and since that time has been adopted by a number of others. Trade to and from these countries can only profit by a uniform system of measures and weights, as it does away with all troublesome and often incorrect reductions.

FROM THE UNITED STATES MINISTER TO AUSTRIA-HUNGARY.

No. 212.]

UNITED STATES LEGATION,
Vienna, October 16, 1896.

SIR: In reply to the Department's note of May 18 last, No. 226, containing a series of interrogatories in regard to the experience of Austria-Hungary when adopting the metric system of weights and measures, and the laws relating thereto, desired for the use of the Committee on Coinage, Weights, and Measures of the House of Representatives, I have the honor to transmit answers to the above as follows:

The metric system of weights and measures was adopted by act of Parliament in Austria-Hungary on July 23, 1871. This act, after enumerating the tables of the metric system, contained a table of the various weights and measures then in use in every part of the monarchy, with their equivalents in the metric system, and all changes from the old to the new system were required by law to be made according to this table. A period of four years and six months, or until January 1, 1876, was allowed for the practical development of the new system, after which date the metric system was made compulsory.

A translation of Articles V and VI of the act of 1871, is as follows:

"ARTICLE V.

"The weights and measures of the metric system, as enumerated in Article III will be exclusively used in public traffic, commencing January 1, 1876. After this period the use of weights and measures used heretofore and which are succeeded by the weights and measures just mentioned, as well as the use of the carat weights and the weight for measuring oil will be prohibited.

"For the measuring of land, however, the Government grants a prolongation of the time and will hereafter make known the period when the new measure will be applied to land.

"ARTICLE VI.

"Anyone illegally using any other system of weights and measures than the metric in public traffic will be fined 100 florins, together with confiscation of these weights and measures. A repetition of the act will be regarded as an aggravating circumstance when passing sentence. The fine will be paid into the poor fund of the community where the act was committed. In case of inability to pay the fine, imprisonment will be substituted, reckoning one day's imprisonment for each 5 florins fined."

The leading wholesale and retail merchants of Vienna inform me that there was a certain amount of confusion experienced in making the change from the old to the new system at first, which was probably greatly due to the natural prejudice against any changes in existing customs, but merchants soon realized that the metric system, already in use in the principal commercial countries of Europe, with which Austria-Hungary had the bulk of her commercial relations, proved to facilitate the mercantile operations between Austria-Hungary and those countries.

On March 31, 1875, or nine months after the new system was made compulsory, Parliament found it necessary to pass a law, fixing the value of fractions of a Kreutzer, in making the transfer from the old to the new system, according to the table of relative values between the old and new systems as published in the original act of July 23, 1871. A translation of the above act of 1875 is as follows:

[Law of March 31, 1875, relating to the change of the present weights and measures to the metric system.]

“ARTICLE I.

“The Government is authorized, when carrying out the new law of the metric system to make such adjustment in the conversion from old to new measure which the nature of the circumstances and the requirements of traffic seem to render necessary.

“ARTICLE II.

“The Government is moreover authorized to change the weight and measure unit which has heretofore served in the assessment of taxes to a corresponding unit in the new system, and to fix the rates of payment according to the unit in the new system. In this adjustment of the amounts assessed, fractions above one-half kreutzer will be considered 1 kreutzer; fractions less than half a kreutzer will be considered as half a kreutzer.”

The universal opinion of the numerous wholesale and retail merchants whom I have interviewed on the subject of the metric system in Austria-Hungary is strongly in favor of the system, and they all agree that there seems to be no desire to return to the old system. The trade and commerce of Austria-Hungary increased steadily after the adoption of the metric system. Between 1870 and 1880, the exports increased from 395,000,000 florins to 676,000,000 florins. The national economists with whom I have spoken on the subject agree that this increase was only in a small measure due to the adoption of the metric system, but statistics show that the trade of Austria-Hungary with countries using the metric system materially increased after its adoption by this country.

I have, etc.,

Hon. RICHARD OLNEY,
Secretary of State.

LAWRENCE TOWNSEND.

FROM NORWAY-SWEDEN.

DEPARTMENT OF STATE,
Washington, July 29, 1896.

SIR: Referring to your letter of May 11 last, I have the honor to inclose copy of a dispatch from our minister to Sweden and Norway, forwarding information in regard to the metric system in those countries.

I have the honor to be, sir, your obedient servant,

W. W. ROCKHILL, *Acting Secretary.*

Hon. CHARLES W. STONE,
*Chairman of the Committee on Coinage, Weights, and Measures,
House of Representatives.*

LEGATION OF THE UNITED STATES,
Stockholm, July 14, 1896.

SIR: On receipt of Department's No. 107, May 18, 1896, as authoritative information was desired on the subject of the adoption of the metrical system of weights and measures by Sweden and Norway, I addressed a note to the minister of affairs, and have the honor to herewith inclose his reply, together with the annexes referred to, with translations of the same.

The metrical system of weights and measures is in use in all the shops which I have visited in Stockholm, and from my observation the adoption of that system is complete and universal.

I have the honor to be, sir, your obedient servant,

T. B. FERGUSON.

Hon. RICHARD OLNEY,
Secretary of State, Washington, D. C.

[Translation.]

ROYAL FOREIGN OFFICE,
Stockholm, July 3, 1896.

Mr. MINISTER: In reference to your letter of March 30, requesting my assistance in obtaining certain information concerning the adoption of the metrical system in the United Kingdoms, I have the honor of transmitting, in the form of inclosures to this letter, two memorials elaborated by the proper authorities and containing the desired information.

With regard to question 3 of your above-named letter, it might be mentioned, in addition to the Swedish memorial, that, according to the opinion of experts, the adoption of the metrical system has proved profitable to the commerce of Sweden, as can be judged.

Pray accept, Mr. Minister, etc.,

DOUGLAS.

[Translation.]

Respectful memorial.

1. The royal ordinance on measure and weight of November 22, 1878, by which the metrical system of measure and weight was introduced in Sweden, was to be enforced from the beginning of 1879, but the older system of measure and weight might remain in use until the beginning of 1889.

The metrical system has been exclusively used at the custom and post offices and for the railway traffic of the Kingdom, pursuant to the prescription of the above-named ordinance, and ever since the beginning of 1881.

The application of the metrical measure for surveying work also commenced at the beginning of 1881; the surveyors, however, must also state the size of the ground plats in old measure in their reports on landed property and pomparty.

The preparative measure for the introduction of the metrical system, however, were not completed before the end of 1878, consequently the proclamation of the board of assay containing detailed regulations on the implements of weighing and measuring was published only on November 13, 1879, and the royal proclamation concerning fees for the assay of measure and weight was not issued until February 27, 1880.

By way of guides for the change into the metrical system of measure private persons published a variety of reduction scales and schedules of the new measures. The new measures and weights, however, were not universally used before the close of the transition period, when they became the only lawful ones.

No trouble of importance has been observed at the transition, though naturally prices will be fixed according to the old measures in many places, especially in distant provincial ones, although the new measures will be used when weighing or measuring wares.

2. Practically the metrical system has proved perfectly satisfactory. The only additions made to it after 1879 were the introduction of a measure of capacity of 1½ hectoliters for measuring dry wares, and of the denomination ton for 1,000 kilos, and "deciton" for a tenth part of a ton, or 100 kilos. For the requirements of the post-office special weights are assayed of 15 and 125 grams. Several retailers have expressed a wish for a special name of half a kilo, which would correspond to the old pound, but no wish for the reestablishment of the older system has been heard of.

3. The question about the influence of the introduction of the metrical system on the commerce of Sweden might best be answered by the royal board of commerce.

Stockholm, June 22, 1896.

K. LINDBERG.

[Translation.]

Memorial.

With reference to the letter of the 19th instant, of the Royal department, concerning certain interrogatories made by the United States minister at Stockholm on the introduction of the metrical system in Norway, we take the liberty of forwarding the following information:

1. The change from the old system of measure and weights to the metrical system did not cause any trouble of serious importance.

The knowledge of the metrical system was imparted by instruction in the schools, by the publishing of practical models, and by the means of popular notes in the calendars.

The law for the introduction of the metrical system into Norway was issued on

May 22, 1875. From July 1, 1879, the system was actually introduced for public commerce and trade. From this date its employment by the custom office, and for calculating every kind of public fees became obligatory. From July 1, 1882, the metrical law was fully enforced; consequently from that date the use of the new system has been obligatory in Norway at the purchase and sale of wares and at the payment of fees or other transactions.

The period of transition from the old system to the new one consequently comprised three years.

During the course of the first two years of this period of transition the owners of old weights were furnished with occasions of having their old weights of 1 pound and more corrected and assayed so that the so-called "skaal pund" (about 1 English pound) was increased to one-half kilogram. The old steelyards were also changed in a way to make the weight marked in the divisions of the steelyard equal to one-half kilogram for each pound.

The bushel for measuring corn was also adjusted to 140 liters and the one-half bushel to 70 liters.

In the third year of transition the same adjustments were made at a certain charge.

Afterwards every kind of correction was forbidden.

(NOTE.—It should be observed that before the public metrical law of 1875 the weight in grams had been used as apothecaries' weight in Norway from July, 1871, having been introduced by the law of May 3, 1871.)

2. It is beyond doubt that in Norway the metrical system has proved to be a practical and easy one, useful and well adapted for every kind of practical trade, and certainly nobody in this country would wish to return to the old complicated system.

3. Whether the introducing of the metrical system has had any direct influence on commercial circulation in Norway is a question which may be rather hard to solve, except that naturally the use of this system has facilitated the intercourse with other countries which are also using it.

LETTER FROM PROFESSOR FOERSTER, CHIEF OF THE GERMAN BUREAU OF WEIGHTS AND MEASURES.

BERLIN, *August 9, 1896.*

MY DEAR FRIEND: In compliance with the request made of me on the 20th of last May for information respecting the introduction of the metric system into Germany and the experience it has had in introducing the same, I send you the following statement:

The introduction of the metric system into Germany—that is, into the territory of the then North-German Confederation, in accordance with the resolutions of the Federal Council and the Parliament of that Confederation, was published in the *Gesetzblatt* of August 17, 1868.

It was provided that the adoption of the metric system, instead of the system of weights and measures that had hitherto prevailed, should be optional on January 1, 1870, and obligatory on January 1, 1872.

In February, 1869, a new standards commission was appointed, of which I was a member. This commission was charged with taking measures for the introduction of the metric system in the entire Confederation; with aiding and supporting it in every way; with superintending it, and, finally, with definitively carrying it into effect.

Until the date of the optional introduction of the new system (January 1, 1870) I had ten months' time to provide all the offices for the verification of weights and measures in the entire country with the standards of the weights and measures of the metric system, so that they might begin immediately to legalize metric weights and measures. The manufacturers of weights and measures also had to be provided with the standards within a few months, in order that they might begin to make the new weights and measures in great number and with the proper accuracy.

The solution of the problem was successful, mainly from the fact that in all the industrial and technic classes of the population the decimal character of the new system was understood and appreciated with a kind of enthusiasm.

This explains why it was that, in the first half of the year 1870, scarcely a year and a half after the publication of the new law, a large part of the people had procured and begun to employ the new weights and measures.

In the middle of the year 1870 occurred the war with the fatherland of the metric system. Some interruption of the reform, of course, now occurred. But after the spring of 1871, in which the whole reform was extended to a now fully united Germany, the introduction of the new system became more energetic, notwithstanding much aversion on the part of the people to the "French system." And when, in 1872, the date approached after which metric measures and weights alone should be legal and the employment of the old weights and measures in all business should entirely cease, all places in all Germany in which goods were sold may be said to

have been provided with, and to have learned the use of, meter sticks, liter measures, and the series of gram weights.

It was surprising with what rapidity the liter measures, especially in the trade in fluids, came into use. Here evidently the simple relation between this unit of measure and the volume of a quantity of water whose weight is equal to the unit of weight was, together with other circumstances, of great importance. I remember that when I then published the tables which have since become so simple, and which serve to determine the volume of a barrel, in liters, by means of the weight expressed in kilograms, of the quantity of water required to fill it, I received from the industrial classes many grateful acknowledgments and many thanks for having helped them to facilitate and simplify the process both from a technic and a moral point of view.

The introduction of the new weights took place under peculiar circumstances, some of which promoted while others hindered it. Thus Germany had since 1858 the so-called zollfund, or customs pound, which was exactly half a kilogram. This unit was not divided into 500 grams, but in the different States of Germany in the most various ways; in the greater part of Germany into 30 loth, and only in the Kingdom of Hanover more rationally into 1,000 half grams.

An old weight of 2 pounds, for instance, was now exactly equal to a kilogram, and hence the old weights of the pound series had to be still considered lawful, while the old weights below 1 pound had to be replaced by new ones of the gram series. Hence the pound unit had to be maintained for a time side by side with the gram unit and the kilogram unit, and this caused, especially when decimal and centesimal scales, which were being rapidly introduced, were employed, great variations and rendered more difficult the full use of the decimal principle of weight division which affords such great advantages, especially when the multiplying scales, i. e., the decimal and centesimal scales, are employed.

From a physical point of view, therefore, the existence of the one-half kilogram as the customs pound facilitated the introduction of the metric system; while, from an intellectual point of view, it rendered it more difficult.

It may be considered certain the employment of decimal multiplying scales which has become very general in recent times will greatly favor the introduction of the gram system to the exclusion of all other units and divisions so that, at least in wholesale trade, the substitution of the new arrangements for the old will meet with the fewest obstacles in the case of weights.

With respect to linear measure it may be said that the meter made headway in Germany more slowly than the liter and the gram systems, mainly because previously all Germany made use of an ell unit which varied but little in the various German States, which was nearly two-thirds of a meter. The difference was too great to permit the purchasing public simply to transfer the old prices per ell to the meter, as such prices might perhaps be transferred, and with a much closer approximation, from the yard to the meter, to the great convenience of the public; nor would it cause loss to sellers, because the latter have always the possibility of compensating for whatever differences may exist by other modifications of price.

With respect to the other unit of length, the foot, the conditions in the United States are the same as they were in Germany. In Germany people always said, "The meter is so long, we can estimate by the foot but not by the meter," and in support of this assertion the fact was cited that at the distance of ordinary clear vision the eye can judge of the length of objects in the field of view in feet but not in meters.

Now, experience has shown that here too people have only hung a cloak around habit in order to hide its nakedness. Our scientific men and architects soon accustomed themselves to the use of the meter in their estimates and other labors.

The description I have given above of the rapid introduction of the metric system in trade and the technic arts and in industry, would be incomplete if I do not add a few words on the comparatively greater slowness with which the metric weight and measures were employed by the so-called common people and by women in their housekeeping, and also to the relative slowness with which the use of the old weights and measures disappeared. The new system was especially slow of adoption by the country population, but still more rapid than anyone expected it would be.

It was of great advantage to housewives that, beginning with 1869, decimal fractions were taught in all the schools and were treated of in all school arithmetics, children learning the value of figures right and left from the decimal point. They were thus enabled to be of great assistance at home. It was so in my own family, where the advantages of the decimal system were fully recognized without any instruction from me, and before I could bestow any attention to it as a matter of domestic concern.

But what is most essential and decisive in all such great measures is not the behavior toward them of the great crowd, but that of science and industry as well as wholesale trade, as I have explained at the end of my essay on the standards system. (See page 112 of Vol. II of my collection, which you have).

With the kindest greetings,

Prof. W. FOERSTER.

EXTRACT FROM THE YEARBOOK OF THE UNITED STATES DEPARTMENT OF AGRICULTURE
FOR 1895, PAGE 614.

The metric system has been made compulsory in France, Germany, Austria-Hungary, Belgium, Spain, Portugal, Italy, Norway, Sweden, Switzerland, Servia, Roumania, Mexico, Brazil, Peru, Venezuela, and Argentina. In Great Britain, Japan, and the United States the system is legalized, but its use is not compulsory. Russia and Denmark stand alone in not having taken any action, but even these countries are contributors to the International Bureau of Weights and Measures.

In all the different countries in which this system has been adopted the change from the system previously in use was made without the slightest difficulty, but it is hardly necessary to point out that unless the metric system had been distinguished by great simplicity it would not have commended itself to so large a number of the nations of the world, with all their various peculiarities and prejudices. Its superior character, both as regards simplicity and scientific precision, was recognized by the United States at an early day, and as long ago as 1866 Congress legalized the system in this country, and authorized the Secretary of the Treasury to distribute to each State of the Union a set of metric standards of weights and measures, which was done. It has since authorized on different occasions the participation of the United States Government in the various operations that have been advocated by the International Bureau of Weights and Measures.

Our present system has for its sole recommendation that it has been in common use for many years. It is irrational in theory and irksome in practice, and is almost entirely without authorization in the history of Congressional legislation.

LETTER OF ISAAC MONDSCHEN, ESQ.

CINCINNATI, August 26, 1896.

DEAR SIR: In answer to your request to give you my observations of the effect of the adoption of the metric system in United Germany, I submit the following:

When, in 1871, the new German Empire was erected upon the ruins of the Franco-German war, a dream of all lovers of the old Fatherland was realized. It was again one united country, under one head, and with one National Parliament. The leading German statesman, Prince Bismarck, realized that in order to cement the unity of the different states comprising the Empire it was necessary to abolish the confusing diversity of not alone money, but of measures as well.

Before 1871 every one of the little states had its own coinage system, differing widely from that of the neighboring states, but a few miles distant. Prussia had the thaler and silbergroschen; Bavaria, the gulden and kreutzer; Bremen, the groten; others, the florin, the ducates, the napoleons, etc. In looking about for the best system to adopt or imitate, it was found that the decimal system of France and the Latin Union was the most practicable, because the most simple. In adopting it only the nomenclature was changed. The French franc became the German mark, the centime the pfennig. The change from the hitherto great mixture of moneys was hailed by the people with delight and adopted without any trouble at all.

But a yet greater revolution was contemplated toward unification of the German people. A change found to have become absolutely necessary, not alone for the simplification of the internal commerce, but also in aid of the rapidly developing foreign commerce of Germany. This was the adoption of a uniform system of measuring things.

In this the diversity was not so great as in the money standards. The "elle" was the unit of the measure of distance in the greatest portion of Germany, the "pfund" of weights, and the "maas" of liquids.

The great German statesman and his collaborators again turned to the French example and adopted the metric system, for the same reason that induced him to adopt the French money system, because of its adaptability, practicability, simplicity, and especially because of its almost universal use by surrounding nations. It was made a law, to go into effect in 1873.

The writer at that time was a clerk in a general store in a small town in the province of Hesse-Nassau, and remembers very well the commotion and fears of the storekeepers and customers that the new system would be so complicated that they never could learn it or become used to it. And so it seemed, in fact, but only because they found it necessary, for the time before the law went into effect, to translate their old measures into the new ones, and vice versa. That naturally necessitated much figuring, compounding, and fractions. But their fears proved groundless, for one day the officers of the Government came around with the actual new measures—the meter, the kilogram, the liter, etc., and notified the people that,

commencing on such and such a day, none but these measures could be used lawfully to sell or buy with. The day came around, and, the metric measures being in actual use, there was no longer any necessity for comparing them or translating them into the old method. Everybody "fell into" it at once without any difficulty, and it wasn't a week until everybody was asking how it was possible they could have got along so long with the old, cumbersome way of measurements. The only difficulty at first was the pronunciation of the strange names. That also was overcome in a short time. They found the new system as simple as their money system.

My employer only found it necessary to change the prices of his goods to conform with the new measures—a task that was completed in two evenings.

The greatest beneficiaries of the new system, however, were the school children and school teachers. The hitherto dreaded arithmetic was dreaded no longer. There were no more fractions to be calculated incident to the old system of "1 pfund = 12 loth, 1 elle = 16 zoll," etc. It all was learned so much easier calculating by the 10's and 100's of the new system.

The adoption of the metric system also gave a wonderful impetus to Germany's foreign trade; a natural result, since their customers in foreign countries found it no longer necessary to translate their measures into the German and vice-versa. The measures of seller and buyer being alike facilitated, simplified matters greatly, and stimulated commercial intercourse.

The metric system is now adopted everywhere in the world, excepting only in the United States and Great Britain. It has a scientific and not an arbitrary basis. It is easily learned and understood as soon as the old measures are out of the way and the people have nothing else to measure and compare with. Its adoption will especially benefit our commerce with Mexico, and South and Central American countries, in all of which it is in daily use.

It will prove a boon to our children in the learning of arithmetic.

Great Britain will adopt it in 1900. Can America afford to be the only country to hold fast to a mediæval system discarded by all the world?

Yours, respectfully,

ISAAC MONDSCHEN.

Hon. CHARLES W. STONE,

*Chairman of Committee of Coinage, Weights, and Measures,
Washington, D.C.*

LETTER FROM ARNOLD SCHLAET, ESQ.

NEW YORK, January 13, 1897.

DEAR SIR: Relating to the introduction of the metric system in the German schools from 1869 to 1873, I well remember my own experience, being at a German school at that time, and while up to the time of the change we were taught the use of the decimal system as an abstract study, it was made a subject of no more import than it now is in the primary schools of this country, and all the school children, and probably also the teachers, more or less dreaded the change. The advantages, however, of figuring with decimals, and the ease with which calculations could be made and the system generally applied, quickly transformed this dread into delight. It was also astonishing to note the rapidity with which even the older people, who had reckoned all their lives with thalers, groschen, and pounds, learned to use the new system in practice; and while the engineering profession and other scientific bodies had used it for many years and always advocated its general adoption, there is no question that the people generally became its more earnest champions after it was once in general use.

The farmers and the masses of the people, to whom figures are usually difficult, found the metric system of such simplicity that even the strong national feeling which arose after the Franco-German war, and which looked to the maintenance of everything German, was not sufficient to hinder the general glad acceptance of this so-called French system and the acknowledgment of its superiority. It is claimed that because of the previous use of the old German pound, which was exactly the same as the half kilo, that the change was made much easier. That may be true, but, on the other hand, the Germans had to readjust themselves altogether on the money unit, a much more difficult and important matter, and which will here be unnecessary, as in that respect we are already on the decimal basis.

In the pursuit of my business I visit Europe frequently for the purpose of introducing American manufactures. I can state, from my own experience, that we are frequently handicapped to a considerable extent by not being able to adjust ourselves as sellers to the views of buyers in the matter of weights and measures. Particularly is this the case in articles where we meet competition of other nations, as, with the exception of our own country, England, and Russia, the world practically

buys and sells by the metric system. If we sell goods by the pound or gallon on the European continent, or in South and Central America, it often means that the respective importer has not only to figure out the differences, but must frequently readjust the packages to "kilos or liters," as the case may be, in order to bring the goods into his own market in the way the people want them and understand them. All that means expense and trouble, of which we must finally bear the cost, or if unwilling or unable, then leave the field to our foreign competitors.

It is generally impracticable to put up goods of one weight or measure for export and of another for home consumption, as few manufacturers work for the export trade in a sufficiently large way to warrant that expense, and in any event it means an additional cost and a handicap to that extent.

I believe in the metric system in the interest of an extension of American trade, and I believe in it because I am in sympathy with the American schoolboy, one and all of whom, I believe, will bless the day when the metric system is finally adopted.

Yours, very truly,

ARNOLD SCHLAET.

Hon. C. W. Stone, M. C.,

*Chairman of the Committee on Coinage, Weights, and Measures,
House of Representatives, Washington, D. C.*

FROM RUSSIA.

DEPARTMENT OF STATE,
Washington, May 13, 1896.

SIR: Adverting to the Department's letters to you of March 5, last, and 11th ultimo, I have the honor to inclose, for your information, a copy of a further dispatch from the United States minister at St. Petersburg. No. 291, of April 25, 1896, showing a disposition favorable to the adoption of the metric system by the Russian Government.

I have the honor to be, sir, your obedient servant.

RICHARD OLNEY.

Hon. CHARLES W. Stone,

*Chairman of the Committee on Coinage, Weights, and Measures,
House of Representatives.*

LEGATION OF THE UNITED STATES,
St. Petersburg, April 25, 1896.

SIR: Referring to my No. 258, of March 25, relating to an inquiry made by Hon. Charles W. Stone, of the House of Representatives, about the position of the Russian Government in regard to the adoption of the metric system, I now have the honor to inclose, herewith, copy and translation of a note from the foreign office of April 8-20, showing to a certain extent a disposition favorable to the adoption of that system.

I have, etc.,

CLIFTON R. BRECKINRIDGE.

Hon. RICHARD OLNEY,

Secretary of State.

IMPERIAL MINISTRY OF FOREIGN AFFAIRS,
DEPARTMENT OF INTERIOR RELATIONS,
St. Petersburg, April 8-20, 1896.

MR. MINISTER: By the note of January 7 [February 8] you have kindly transmitted to the Imperial ministry of foreign affairs the request of the Government of the United States concerning the adoption by the Imperial Government of the metric system of weights and measures which America and England propose to adopt.

The Imperial ministry of foreign affairs having put itself in communication with the Imperial ministry of finance upon that question, I have the honor to inform you that while the Imperial Government sees no objection to the adoption of the system in Russia, it could only pronounce itself in its favor after having it introduced as a necessary preliminary into commerce, and after having regulated the use of the weights and measures now current.

Please to accept, etc.,

CHICKINE.

DEPARTMENT OF STATE,
Washington, May 26, 1896.

SIR: In connection with a letter from this Department of the 13th instant, I have now the honor to inclose for your information a copy of a dispatch from the United States minister at St. Petersburg (No. 301) of the 7th instant, concerning the metric system in Russia.

I have the honor to be, sir, your obedient servant,

RICHARD OLNEY.

Hon. CHARLES W. STONE,
Chairman of the Committee on Coinage, Weights, and Measures,
House of Representatives.

LEGATION OF THE UNITED STATES,
St. Petersburg, May 7, 1896.

SIR: In further relation to the attitude of Russia toward the adoption of the metric system, about which inquiry was made by Hon. Charles W. Stone, of the House of Representatives, I have the honor to inclose, herewith, copy and translation of an account from the Journal de St. Petersburg of favorable conclusions reached by a consultative scientific society at Moscow.

I have the honor, etc.,

CLIFTON R. BRECKINRIDGE.

Hon. RICHARD OLNEY,
Secretary of State.

[Journal de St. Petersburg, 23 Avril (5 Mai), No. 110.—Translation.]

The Society of Naturalists of Moscow, which the Imperial Technical Society has asked to join with it in steps looking to the introduction of the metric system into Russia, has examined this request in its seance of April 18 and pronounced in favor of the opportuneness of the reform in question, declaring that it would be necessary to fix a term of two years, after which the introduction would become obligatory for all, although the departments of the State, such as the post, excise, the ministry of war, the navy, and the ways of communication, could adopt it without delay.

RESOLUTIONS OF THE ASSOCIATION OF AMERICAN AGRICULTURAL COLLEGES AND EXPERIMENT STATIONS.

[Adopted November 12, 1896.]

Whereas the present system of weights and measures in use in the United States militates seriously against our trade with foreign countries, and in order to better facilitate comparisons of experimental data obtained at home and abroad, as well as to effect an important saving of time in the education of our youth; and furthermore, in view of the rapid growth of the country which increases continually the difficulties involved in a change,

Be it resolved, That this association through its executive committee transmit a communication to Congress, urging the importance of the early adoption of the metric system of weights and measures as the only legal standard for the United States.

RESOLUTIONS OF THE ASSOCIATION OF AMERICAN STEEL MANUFACTURERS.

STEELTON, Pa., May 23, 1896.

DEAR SIR: Answering your favor of the 22d instant, I would say that the following resolution was adopted at the Pittsburgh meeting of the Association of American Steel Manufacturers, on April 17, 1896:

Resolved, That this association hereby indorses House of Representatives bill No. 7251 establishing the metric system of weights and measures, and requests that the individual members of the association correspond with their Representatives and Senators urging its passage."

The firms and corporations represented at the meeting were as follows: Jones & Laughlins, Pittsburgh, Pa.; Carnegie Steel Company, Pittsburgh, Pa.; Cambria Iron

and Steel Company, Johnstown, Pa.; Bethlehem Iron Company, South Bethlehem, Pa.; Central Iron Works, Harrisburg, Pa.; Pottstown Iron Company, Pottstown, Pa.; Illinois Steel Company, Chicago, Ill.; Carbon Steel Company, Pittsburg, Pa.; Park, Brother & Co., Pittsburg, Pa.; Lukens Iron and Steel Company, Coatesville, Pa.; Pennsylvania Steel Company, Steelton, Pa.; Colorado Fuel and Iron Company, Pueblo, Colo.

A vote being taken on this resolution, it was adopted unanimously.

Yours, truly,

H. H. CAMPBELL,

Secretary Association of American Steel Manufacturers.

Hon. CHARLES W. STONE,

Chairman, House of Representatives, Washington, D. C.

RESOLUTIONS OF THE STATE EDUCATIONAL ASSOCIATION OF NORTH DAKOTA.

[Unanimously adopted at a meeting of the association held at Fargo, N. Dak., December 31, 1896.]

The metric system, by reason of its decimal scale, its simplicity, its international character, and its unquestionable superiority to any other system of weights and measures, is worthy of universal adoption: Therefore,

Resolved, That we recommend to our State legislature the passage of an act requiring the teaching of the metric system in the public schools of the State.

Resolved, That we respectfully request our delegation in Congress to use their influence and votes to bring about the compulsory use of the metric system in the United States.

RESOLUTIONS OF THE PHILADELPHIA ENGINEERS' CLUB.

[Adopted April 18, 1896.]

Whereas the adoption of an international system of weights and measures is a subject of great practical importance; and

Whereas the metric system is the most convenient general system now in use, and its continued extension indicates that it is the only existing system of weights and measures that bears promise of universal adoption; and

Whereas it is believed that the difficulties in the way of its adoption are far more than compensated by the advantages to be gained by its use; and

Whereas the question of the establishment of the metric system is now under consideration by Congress: Therefore,

Resolved, That the Engineers' Club of Philadelphia respectfully urges its representatives at Washington to advocate the adoption of the metric system as the only legal standard in the United States, and to promote such international cooperation as will provide unity of practice among commercial nations.

LETTER FROM THE CITY ENGINEER OF ALBANY, N. Y.

ALBANY, N. Y., May 7, 1896.

MY DEAR MR. REES: I have talked with Mr. Cole, the superintendent of public schools here, and he assures me that instruction is given and has been given for many years in the public schools as regards the metric system. The Albany Academy also, I know, instructs its pupils in this matter. Mr. Cole is very much in favor of the introduction of the metric system, and says that the pupils very soon forget what is taught them regarding the metric system, never having occasion to use their knowledge. I do not know of any place where a change would occasion more annoyance than in an engineer's office of a municipality, where old maps must be constantly referred to, but I think the advantages of the change are many, and that opposition is occasioned by a selfish love of ease that is deplorable in the highest degree. It is such a spirit that prevents progress in many directions, and I for one am quite ready to bear my part of the difficulty of making the change.

In old times we had the "Ryland" foot and rod here, and they are referred to in many old deeds and are given on old maps. This was probably a *Rhineland* foot, and its length is 1.0345 English feet, while a rod was 12 feet. I sincerely hope that before the next Congress the bill will receive favorable consideration.

I am, very truly, yours,

HORACE ANDREWS, *City Engineer.*

Prof. J. K. REES,

Columbia University, New York, N. Y.

EXTRACT FROM A COMMUNICATION FROM PROF. MELVIL DEWEY, SECRETARY OF THE UNIVERSITY OF NEW YORK AND DIRECTOR OF THE STATE LIBRARY.

My greater interest, however, arises from the great gain that would accrue to education if we could save the time now consumed in the study of compound numbers. The experience of a score of other nations has shown that this can only be done by the enactment of such a law as has now been favorably reported in Congress. Its provisions are less stringent than in most other countries, and yet will be sufficient to accomplish the purpose more in accordance with our free institutions. As bearing on this, I quote below a page from a circular letter issued almost twenty years ago by twenty-six of the most prominent American educators:

"Careful computation of the result of completely replacing the present weights and measures in our arithmetics by the metric gives a saving of a full year in the school life of every child educated. This startling statement has been repeatedly examined by practical teachers, who have thus far, without exception, arrived at the same conclusion. When it is remembered that it is impossible to get time for various branches which it seems desirable to teach in the public schools, the vast importance of this saving will be apparent. It points to a possibility of giving some attention to subjects for which so strong arguments have been advanced, but for which the most friendly school government has often found it impracticable to provide the time—physiology, elementary science, industrial art, music, drawing. The proposed teaching of the international measures requires but a very limited time, and will in the end save that time over and over again.

"Besides the all-important saving of time, the metric measures should be introduced into the schools as one of the most perfect appliances known for teaching arithmetic to beginners. In the best school systems it has been found of great advantage to teach a child our decimal arithmetic through tangible objects. The law of progression from lower to higher units, addition, subtraction, multiplication, and division, are all made object lessons by means of the metric measures of length and capacity. The metric square and cubic measures illustrate evolution and involution. Every teacher of experience, recognizing the exact correspondence of the tangible measures of the metric system with the numbers and laws of simple arithmetic, will see how valuable an aid is here afforded. Lessons impressed by seeing and handling the objects are known to be infinitely more enduring than mere statements, and the thorough teaching of the metric system is therefore urged as being an introduction of tangible arithmetic. The units, tens, and hundreds of the actual measures are identical with those of the Arabic numbers; one is an abstraction, the other may be seen and felt.

"As the metric multiples correspond perfectly with whole numbers, so the metric fractional units agree with what we term decimals. Decimals may be handled and seen, and the difficulties sometimes experienced in making younger pupils understand their laws will be largely obviated when these laws are made object lessons through decimal measures.

"The committee has given only educational reasons for the step proposed, reasons which are seldom brought into prominence except by teachers. There has been no mention of the greater arguments of economy in commercial and international relations, and the fact that the general adoption of the system by this country is recognized, even by its opponents, as one of the inevitable events of the future."

House Report No. 795, Fifty-fourth Congress, first session.

Mr. CHARLES W. STONE, from the Committee on Coinage, Weights, and Measures, submitted the following

REPORT:

[To accompany H. R. 7251.]

The Committee on Coinage, Weights, and Measures, to whom was referred the bill (H. R. 2758) "to fix the standard of weights and measures by the adoption of the metric system of weights and measures," having duly considered the same, respectfully report as follows:

Almost the only power clearly and expressly vested in Congress by the Constitution which has remained practically unexercised to the present day is that of fixing the standard of weights and measures. This power is conferred in the fifth clause of section viii of article 1, which enumerates among the powers of Congress "to coin money, regulate the value thereof and of foreign coins, and fix the standard of weights and measures." The same power had also been expressly vested in Congress by the earlier articles of confederation, and that part relating to the coinage of money was one of the first exercised, and one in relation to which the power of Congress continues to be most fiercely and passionately invoked to the present day.

In the passage of years the power, carrying with it inferentially the duty, to fix the standard of weights and measures seems to have been largely lost sight of. For more than a generation we lived with no legal standard by which could be determined even the amount of metal which went into the coin that came from our mints. Gallatin procured from France a platinum kilogram and meter in 1821 and from England a troy pound in 1827, and in 1828 the latter was recognized as the standard for mint purposes by the following act:

For the purpose of securing due conformity in weight of the coins of the United States to the provisions of this title, the brass troy pound weight procured by the minister of the United States at London in the year eighteen hundred and twenty-seven for the use of the mint and now in custody of the mint at Philadelphia, shall be the standard troy pound of the mint of the United States, conformably to which the coinage thereof shall be regulated.

Meantime both the people and the Government were using such weights and measures as were nearest at hand, derived in the main from their English ancestry, but made by themselves without any authoritative standard for comparison, and as a consequence differing materially from each other. In 1830 the Senate directed the Secretary of the Treasury to have a comparison made of the standards of weight and measure used at the principal custom-houses of the United States and report the same to the Senate. This was done, and large discrep-

ancies and errors were found to exist. These discrepancies were nullifying and violating the provision of the Constitution which prescribes that "all duties, imposts, and excises shall be uniform throughout the United States." Varying scales and varying measures inevitably produced varying rates of duty. The Treasury Department, therefore, in the exercise of its executive power and as a necessary incident and means to the execution of the law and the observance of the Constitution, adopted for the use of that Department the Troughton scale, then in the possession and use of the Coast Survey, as the unit of length, and the troy pound of the mint as the unit of weight. From the latter, the avoirdupois pound was to be derived, assuming that there were 7,000 grains in the pound avoirdupois to 5,760 in the pound troy. For measures of capacity the wine gallon of 231 cubic inches and the Winchester bushel of 2,150.42 cubic inches were adopted. This gave to the Treasury Department the basis of a system of weights and measures to be used in its operations, and in order to promote the general adoption and use of the same throughout the country Congress, in June, 1836, adopted the following joint resolution:

That the Secretary of the Treasury be, and he hereby is, directed to cause a complete set of all the weights and measures adopted as standards, and now either made or in the progress of manufacture for the use of the several custom-houses, and for other purposes, to be delivered to the governor of each State in the Union, or such person as he may appoint, for the use of the States, respectively, to the end that a uniform standard of weights and measures may be established throughout the Union.

In accordance with this resolution sets of the weights and measures adopted for use in the custom-houses were sent to the several States, and only in this indirect and inferential way have the customary weights and measures of the United States been legally recognized. By the act of March 3, 1881, similar sets of standards were directed to be supplied to the various agricultural colleges which had received land grants from the United States at a cost not exceeding \$200 for each set. This law was complied with as best it could be under the limitation of cost prescribed.

Meantime the metric system had come into extensive use among other nations, and into almost universal use in the realm of exact science the world over. We touched it at every turn in our commercial relations and scientific investigations. Uniformity in weights and measures throughout the world was urged not only by scientists but by sagacious business men, seeking to keep pace with the rapidly-growing tendencies to closer commercial and business relations among the nations resulting from the improved facilities of communication and transportation which had largely removed the barriers of space and distance. Hence in 1866 Congress, with the approval of the President, placed on the statute books the following law:

AN ACT to authorize the use of the metric system of weights and measures.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That from and after the passage of this act it shall be lawful throughout the United States of America to employ the weights and measures of the metric system, and no contract or dealing, or pleading in any court, shall be deemed invalid or liable to objection because the weights or measures expressed or referred to therein are weights or measures of the metric system.

SEC. 2. *And be it further enacted,* That the tables in the schedule hereto annexed shall be recognized in the construction of contracts, and in all legal proceedings, as establishing, in terms of the weights and measures now in use in the United States, the equivalents of the weights and measures expressed therein in terms of the metric system; and said tables may be lawfully used for computing, determining, and expressing, in customary weights and measures, the weights and measures of the metric system.

To make this law of practical use the following joint resolution was adopted:

JOINT RESOLUTION to enable the Secretary of the Treasury to furnish each State one set of the standard weights and measures of the metric system.

Be it resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Treasury be, and he is hereby, authorized and directed to furnish to each State, to be delivered to the governor thereof, one set of standard weights and measures of the metric system for the use of the States respectively.

By inadvertence and without important legal significance the resolution providing for furnishing the standards became a law before the act authorizing the use of the system. In the same year Congress put it in the power of the Post-Office Department to make extensive use of metric weights in its operations. The law of that year was restated and reenacted in 1872 and now stands in the Revised Statutes in the following terms:

The Postmaster-General shall furnish to the post-offices exchanging mails with foreign countries, and to such other offices as he may deem expedient, postal balances denominated in grams of the metric system, fifteen grams of which shall be the equivalent for postal purposes, of one-half ounce avoirdupois, and so on in progression.

The International Postal Convention of two years later, and which by subsequent renewals is now in force between the United States and fifty other nations, uses only metric weights and terms, and to-day the mail matter transported between this country and other nations, even between the United States and England, is weighed and paid for entirely in terms of metric weights.

Here legislation on the subject of weights and measures rests till 1893. In the meantime important action was taken by the Executive Department of the Government. The progress of science carrying with it the capability of more accurate observation and measurement, had disclosed the fact that the metric standards in use in different countries differed among themselves, and indicated that even the standards in the Archives of France could be constructed with greater precision and accuracy and preserved with greater safe guards against possible variation from influence of the elements or other forces. Hence, France invited the other nations to join in an international commission for the purpose of constructing a new meter as an international standard of length. This country accepted the invitation and was represented in the commission, which met in 1870 and continued its labors from time to time till they were finally consummated in the conclusion of a metric convention signed on May 20, 1875, by the representatives of the following nations, viz, United States, Germany, Austria and Hungary, Belgium, Brazil, Argentine Confederation, Denmark, Spain, France, Italy, Peru, Portugal, Russia, Sweden and Norway, Switzerland, Turkey, and Venezuela.

The first name signed to this convention is that of E. B. Washburn the United States minister and representative. The treaty provided for the establishment and maintenance at the common expense of the contracting nations of "a scientific and permanent international bureau of weights and measures, the location of which shall be Paris," to be conducted by "a general conference for weights and measures, to be composed of the delegates of all the contracting Governments." Beyond the construction and custody of the international standards and the distribution to the several countries of copies thereof, it was expressly provided as to this conference by the terms of the treaty or convention

that "it shall be its duty to discuss and initiate measures necessary for the dissemination and improvement of the metrical system." This convention was duly ratified by the Senate, and since that time the United States has been regularly represented in the International Conference and has paid its proper proportion of the cost of maintaining the International Bureau of Weights and Measures. By the terms of the convention the privilege of acceding thereto and thus becoming a party to it was reserved to any nations desiring to avail themselves thereof, and accordingly the following nations have since become parties to the convention, viz, Servia in 1879, Roumania in 1882, Great Britain in 1884, Japan in 1885, and Mexico in 1891.

New standards were prepared with extreme care and accuracy, and duplicate copies thereof distributed to the several nations. Those for the United States were received with much ceremony at the White House January 2, 1890, by the President in the presence of members of his Cabinet and other distinguished gentlemen, and are now carefully guarded in a fire-proof room set apart for the safekeeping of the standards of weights and measures in the Coast Survey building.

By formal order of the Secretary of the Treasury of April 5, 1893, the meter and kilogram thus received and kept were recognized as "fundamental standards" from which the customary units of the yard and pound should be thereafter derived in accordance with the law of July 28, 1866.

Meantime Congress by act of March 3, 1893, established a standard scale for measurement of sheet and plate iron and steel, expressed in terms of both the customary and metric measures. "An act to define and establish the units of electrical measure" was passed by the Fifty-third Congress and approved July 12, 1894. It is based on the metrical system exclusively.

From this résumé of our legislation on the subject of weights and measures it appears that a legal standard of weight has been established for use in the mint, but that beyond that our weights and measures in ordinary use rest on custom only with indirect legislative recognition; that the metric weights and measures are made legal by direct legislative permission, and that standards of both systems have been equally furnished by the Government to the several States; that the customary system has been adopted by the Treasury Department for use in the custom-houses, but that the same Department by formal order has adopted the metric standards as the "fundamental standards" from which the measures of the customary system shall be derived. This presents a condition of legal complication and practical confusion that ought not to continue. The constitutional power vested in Congress should be exercised. Before considering how this should be done, it may be instructive to consider the attempts that have heretofore been unsuccessfully made in that direction.

LEGISLATION HERETOFORE PROPOSED.

Washington, in his first message to the First Congress, and in at least two subsequent messages during his term, called attention to the importance of securing uniformity in weights and measures. In his message to the Second Congress he uses these words, viz:

A uniformity in the weights and measures of the country is among the important objects submitted to you by the Constitution, and if it can be derived from a standard at once invariable and universal, must be no less honorable to the public council than conducive to the public convenience.

The House of Representatives referred the matter to the Secretary of State to report a proper plan, and both House and Senate awaited his report. When it came in July, 1790, Mr. Jefferson, then Secretary of State, submitted two distinct plans, but both based on the length of the pendulum or rod vibrating in seconds, as the standard of measure. The first plan was to adapt the existing system to this standard, and thus retain it with all its terms and relations to the other. The second plan was a strictly decimal system, intended to reduce "every branch to the same decimal ratio already established in coins, and thus bring the calculation of the principal affairs of life within the arithmetic of every man who can multiply and divide plain numbers." Starting with one-fifth of the length of his pendulum as 1 foot, which varied but slightly from the foot in actual use, he derived from that a complete decimal system. His table of linear measure would have read as follows:

10 points make 1 line.
 10 lines make 1 inch.
 10 inches make 1 foot.
 10 feet make 1 decad.
 10 decads make 1 rood.
 10 roods make 1 furlong.
 10 furlongs make 1 mile.

The cubic foot constituted his bushel, and from it by division and multiplication decimally he derived his measures of capacity. The weight of a cubic foot of water formed the basis from which he derived his weights, which also bore a decimal relation to each other. Thus he presented a system complete in itself, the various parts maintaining to each other the "uniformity of proportion," with names and terms simple, short, and mainly Anglo-Saxon, easily comprehended and likely to be readily received, and which touched the existing system so closely at points of common departure as to be readily substituted for it. It was homogeneous with our newly adopted currency system, and had it been adopted would probably have formed the permanent and satisfactory system of this nation, and might in time have become the universal system of the world. It was purely and symmetrically a decimal system, less scientific and precise than the metric system subsequently developed, but having all its elements of economy and convenience.

Congress, however, did not adopt it. Coincident with this movement in America, France instituted an effort for the establishment of a uniform international system of weights and measures. The British Parliament seems at that time to have been giving more or less attention to the same subject, and Congress determined to await the outcome of these movements. The next session of Congress, however, having the matter again pressed on their attention by Washington, the Senate referred the matter to a special committee, which, in April, 1792, reported in favor of the adoption of Jefferson's second or decimal plan, but no action was taken thereon by the Senate. Jefferson himself expressed no choice, but, as he afterwards said, left Congress to "take the one or the other, according to the degree of their courage." Later he expressed a very decided preference for the decimal system, but never brought himself to assent to the metric system of France, largely, perhaps, from antagonism to their method of deriving the standard from measurement of an arc of a meridian of the earth's surface, instead of taking the length of a pendulum vibrating in seconds, which he advocated and which the English afterwards adopted. In 1817, in his letter to Secretary Adams, he alludes to the failure of the English "to reduce into any sensible

order the chaos of their weights and measures," and adds, "I sincerely wish you may be able to rally us to either standard and to give us one unit, the aliquot part of something invariable which may be applied simply and conveniently to our measures, weights, and coins, and most especially that the decimal divisions may pervade the whole," a seemingly complete and accurate description of the metric system.

On the 8th of January, 1795, the President transmitted to Congress a communication recently received from the French minister describing the newly adopted metrical system of France, which her statesmen and scientists sought to have made universal. This communication, together with Jefferson's plan, was duly considered by a committee of the House which only reported a general plan, dependent for its practical development on certain further experimental investigation, which Congress failed to authorize. The subject continued to receive more or less spasmodic and inconclusive attention during the next generation, during which we were passing through our troubles with France and second war with England.

Meantime the metric system, originating in France, but in the preparation of which Denmark, Sweden, Netherlands, Spain, Switzerland, Sardinia, Rome, and the Cisalpine and Ligurian Republics had also taken part, and carried by the victorious arms of Napoleon into many of the nations of Europe, was maintaining a checkered and uncertain existence. Nations on which it had been imposed by the will of a foreign conqueror rejected it when that mastery was removed, and even in France itself it fluctuated for years between general and partial acceptance and ultimate rejection. That nation was then in a turbulent period of unrest and instability, of radical innovations, of rash and reckless experiments. The attempt to engraft the decimal system on to the division of time had failed. The adaptation of the decimal system to the measurements of the circle had not succeeded. The Government, by formal decree, had recognized the use of the old weights and measures as permissive and legal. The practical success of the new system for everyday life and its uses was in much doubt. Hence, when Madison, in his message to Congress in December, 1816, again brought the matter to their attention, he evoked but a languid and perfunctory response. His language was clear and emphatic, as follows:

Congress will call to mind that no adequate provision has yet been made for the uniformity of weights and measures contemplated by the Constitution. The great utility of a standard fixed in its nature, and founded on the easy rule of decimal proportions, is sufficiently obvious. It led the Government at an early stage to preparatory steps for introducing it, and a completion of the work will be a just title to the public gratitude.

Congress referred the matter to the Secretary of State, but two years later, and before he reported, a committee of the House of Representatives, in January, 1819, made a report substantially adopting the first plan submitted by Jefferson thirty years before, and providing for putting it into effect, but Congress failed to approve the recommendations of the committee.

On February 22, 1821, the wonderfully learned and elaborate report of John Quincy Adams, then Secretary of State, was transmitted to the Senate. It was exhaustive in its treatment of the subject both historically and philosophically. He did not fail to appreciate the importance and desirability of a universal system, nor to recognize the merits and advantages of the new metric system, but he stood appalled by the difficulties in the way of its introduction and discouraged by the experience of its friends in the nation of its birth, and by the then atti-

tude toward it of that and other countries where it had been introduced. This is indicated by the following extract from his report:

Among the nations of modern Europe there are two who, by their genius, their learning, their industry, and their ardent and successful cultivation of the arts and sciences, are scarcely less distinguished than the Hebrews, from whom they have received most of their religion, or the Greeks, from whom they have received many of their civil and political institutions. From these two nations the inhabitants of these United States are chiefly descended, and from one of them we have all our existing weights and measures. Both of them for a series of ages have been engaged in the pursuit of a uniform system of weights and measures. To this the wishes of their philanthropists, the hopes of their patriots, and the researches of their philosophers, and the energy of their legislators have been aiming with efforts so stupendous and with perseverance so untiring that to any person who shall examine them it may well be a subject of astonishment to find that they are both yet entangled in the pursuit at this hour, and it may well be doubted whether all their latest and greatest exertions have not hitherto tended to increase diversity instead of producing uniformity.

It is not strange, then, that from his point of observation he should have believed the introduction of the metric system in the United States impracticable, and should have so reported. The following passage of exquisite beauty and eloquence shows, however, that he fully appreciated the symmetry, beauty, and desirability of this system:

This system approaches to the ideal perfection of uniformity applied to weights and measures, and, whether destined to succeed or doomed to fail, will shed unfading glory upon the age in which it was conceived and upon the nation by which its execution was attempted and has been in part achieved. In the progress of its establishment there it has often been brought in conflict with the laws of physical and of moral nature with the impenetrability of matter, and with the habits, passions, prejudices, and necessities of man. It has undergone various important modifications. It must undoubtedly still submit to others before it can look for universal adoption. But if man upon earth be an improvable being; if that universal peace, which was the object of a Savior's mission, which is the desire of the philosopher, the longing of the philanthropist, the trembling hope of the Christian, is a blessing to which the futurity of mortal man has a claim of more than mortal promise; if the spirit of evil is, before the final consummation of things, to be cast down from his dominion over men, and bound in the chains of a thousand years, the foretaste here of man's eternal felicity, then this system of common instruments, to accomplish all the changes of social and friendly commerce, will furnish the links of sympathy between the inhabitants of the most distant regions; the meter will surround the globe in use as well as multiplied extension, and one language of weights and measures will be spoken from the equator to the poles.

And later on in his report, after giving a history of the construction of the new system and of the unsuccessful effort to apply the decimal system to the division of time, he proceeds to a comparison of the English and what he terms the French system, and to a discussion of the advantages of the latter, over which he again grows enthusiastic, as follows:

The single standard, proportional to the circumference of the earth; the singleness of the units for all the various modes of mensuration; the universal application to them of decimal arithmetic; the unbroken chain of connection between all weights, measures, moneys, and coins; and the precise, significant, short, and complete vocabulary of their denominations; altogether forming a system adapted equally to the use of all mankind; afford such a combination of the principle of uniformity for all the most important operations of the intercourse of human society; the establishment of such a system so obviously tends to that great result, the improvement of the physical, moral, and intellectual condition of man upon earth; that there can be neither doubt nor hesitancy in the opinion that the ultimate adoption and universal, though modified, application of that system is a consummation devoutly to be wished. * * *

Considered merely as a labor-saving machine, it is a new power offered to man incomparably greater than that which he has acquired by the new agency which he has given to steam. It is in design the greatest invention of human ingenuity since that of printing.

Balancing between his admiration of the new system and his misgivings and doubts as to its general acceptability and practical success, he recommends to the United States a policy of waiting, of observation, of domestic inaction, and of foreign inquiry and investigation, as follows:

These views are presented as leading to the conclusion that, as final and universal uniformity of weights and measures is the common desideratum of all civilized nations; as France has formed, and has for her own use established a system adapted by the highest efforts of human science, ingenuity, and skill to the common purposes of all; as this system is yet new, imperfect, susceptible of great improvements, and struggling for existence even in the country which gave it birth; as its universal establishment would be a universal blessing, and as, if ever effected, it can only be by consent and not by force, in which the energies of opinion must precede those of legislation, it would be worthy the dignity of the Congress of the United States to consult the opinions of all the civilized nations with whom they have a friendly intercourse, to ascertain with the utmost attainable accuracy the existing state of their respective weights and measures, to take up and pursue with steady, persevering, but always temperate and discreet exertions, the idea conceived and thus far executed by France, and to cooperate with her to the final and universal establishment of her system. * * *

In contemplating so great but so beneficial a change as the ultimate object of the proposal now submitted to the consideration of Congress, it is supposed to be most congenial to the end to attempt no present change whatever in our existing weights and measures; to let the standards remain precisely as they are, and to confine the proceedings of Congress at this time to authorize the Executive to open these communications with the European nations where we have accredited ministers and agents, and to such declaratory enactments and regulations as may secure a more perfect uniformity in the weights and measures now in use throughout the Union.

Congress assented to these views. It probably would have adopted this policy, whatever might have been his recommendation. The time was inopportune for the advent of the new system, and no other claimed serious consideration as a rival. Hence to do nothing was the natural and easy thing, and the constitutional power vested in Congress remained unexercised. Meantime the nations began to accomplish by separate action what Adams evidently thought could only be done by concerted and united effort. One nation after another adopted or returned to the metric system, until to-day the situation in the civilized world is exactly the reverse of what it was when Adams wrote, and, instead of only two or three nations struggling to establish and maintain the system, but two or three now remain to withhold their allegiance from it, and that but partially.

Adams concludes his report in the following words:

France first surveyed the subject of weights and measures in all its extent and all its compass. France first beheld it as involving the interests, the comforts, and the morals of all nations and of all after ages. In forming her system she acted as the representative of the whole human race, present and to come. She has established it by law within her own territories, and she has offered it as a benefaction to the acceptance of all other nations. That it is worthy of their acceptance is believed to be beyond question. But opinion is the queen of the world, and the final prevalence of this system beyond the boundaries of France's power must await the time when the example of all its benefits, long and practically enjoyed, shall acquire that ascendancy over the opinions of other nations which gives motion to the springs and direction to the wheels of power.

The conditions of this closing sentence have been fully met. The "example of all its benefits, long and practically enjoyed," in a score of nations now commends the merits of the metric system to the confidence and acceptance of the few who have not yet adopted it.

Returning to the course of legislation and executive effort in this country, nothing occurred worthy of note not heretofore mentioned till 1847, when Secretary of the Treasury R. J. Walker urged upon Congress in his report the importance of a uniform and decimal system of weights

and measures, and soon after Professor Bache, who had lately succeeded Mr. Hassler as Superintendent of Weights and Measures, more at length and more forcibly invoked the action of Congress, citing the adoption of the metric system by Spain, Belgium, Greece, Holland, Lombardy, Poland, and Switzerland in Europe, and Chile, Colombia, and Mexico on this continent. The legislature of Maine and several other States about this time passed resolutions in favor of an international decimal system of weights and measures and coinage.

Secretary Chase in his report of December 9, 1861, gave his indorsement to the movement; but the war had begun and the preservation of the nation's life, and not the particular kind of weights or measures it should use, was the all-engrossing question. This country was meantime represented in various international postal and statistical congresses, all giving substantial approval of the new system. A bill had passed the House of Commons to make the use of the system compulsory in England, but failed in the House of Lords. Subsequently both Houses agreed on a permissive bill, and the United States followed their example in 1866. Elaborate reports in favor of its more complete adoption were made by the Committee on Coinage, Weights, and Measures in the Forty-fifth and Forty-sixth Congresses.

The International American Conference, held in Washington in 1890, unanimously adopted the following resolution:

Resolved, That the International American Conference recommends the adoption of the metrical decimal system to the nations here represented which have not already adopted it.

The letter of Secretary Blaine, transmitting to the President their proceedings, and by him submitted to Congress, is as follows:

DEPARTMENT OF STATE, Washington, July 12, 1890.

THE PRESIDENT:

I have the honor to transmit herewith a copy of the report on weights and measures as unanimously adopted by the International American Conference. This report, as will be seen, recommends the adoption by the United States of the metrical decimal system of weights and measures, which is now in use by the Governments and people of all the other American Republics and most of the nations of Europe, and which is already authorized by the laws of the United States. The adoption of this system in the customs service would, it is believed, greatly promote the public convenience, and I beg leave to submit, for the consideration of Congress, the draft of a bill for that purpose.

Respectfully submitted.

JAMES G. BLAINE.

Secretary of the Treasury Windom, in his report of December 1, 1890, concurs in the recommendation of Secretary Blaine in the following words:

The metric system of weights and measures was optionally established by law in 1866. Since that time it has become obligatory among nearly all civilized peoples, and its use in this country was strongly urged by the International American Conference lately in session at Washington. Upon consideration of the matter it is recommended that the metric system be made obligatory in transactions at our custom-houses from and after the first day of the calendar year 1895. A statutory provision to that effect would doubtless lead to the general adoption of the system by the public, unaccompanied by serious inconvenience.

In his report of December 7, 1891, Secretary Foster makes the same recommendation as follows:

For the reasons stated in the last report of my predecessor, I renew the recommendation made by him that the metric system of weights and measures be made obligatory in transactions at United States custom-houses from and after the first day of the calendar year 1895.

In 1892 he recurs to the subject on page 74 of his report as follows:

I renew the recommendation made in my last annual report and in the annual report of my predecessor that early action should be taken by Congress toward such legislation as will make the use of the metric system of weights and measures obligatory in transactions at United States custom-houses on and after the first day of the calendar year 1895. The adoption of this system by the chief commercial countries of Europe and the recent action of most of the chambers of commerce in Great Britain recommending its early introduction into that country lend added force to the reasons for the enactment proposed.

And in his report for 1893 Secretary Carlisle announces the adoption of the meter and kilogram as fundamental standards in the following language:

A bulletin was issued in April, 1893, by the Superintendent of Weights and Measures, approved by the Secretary of the Treasury, announcing that in the future the office would regard the international prototype meter and kilogram as fundamental standards, thus putting our weights and measures in direct relation with those of all other civilized nations.

These repeated recommendations of the Secretaries of State and Treasury seem to have been received by Congress with indifference and speedily forgotten. In the British Parliament, however, more substantial progress has been made. The special committee of the House of Commons to whom the subject was referred, with but a single dissenting voice have submitted a report in favor of the general adoption of the metric system, and its friends in England are sanguine of favorable action by Parliament in no very distant future. Such action would undoubtedly be hastened and rendered certain by positive action by the United States. The most reliable information indicates that Russia would cheerfully and promptly join in such action as the United States may take, and then the grand desideratum of a uniform system of weights and measures, universal throughout the civilized world, would be realized, a serious obstacle in the way of commercial intercourse would be removed, and a long step taken toward a closer union, a grander "federation of the world."

EXISTING CONFUSION.

Passing now from the parliamentary history of the efforts and failures to put in force the constitutional power and inferentially the constitutional command to "fix the standard of weights and measures," let us consider the actual, existing facts that confront us. We have legally established and scientifically determined standards for the measurement of electricity. These are exclusively on a metric basis, international in character and practically universal throughout the world.

We have a somewhat complicated but legally established scale for the measurement of the thickness of sheet and plate iron and steel, and this interchangeably or optionally by the metric or customary measures. We have a troy pound weight, the legal standard for weighing in the mint. Beyond this we have only custom without coherence, stability, or uniformity.

The troy pound of the mint is resorted to as the only source from which to derive the avoirdupois pound for common use, and yet this troy pound, while answering the purposes of comparison in the mint, is of uncertain accuracy. It is a copy of the old English standard pound kept in the Tower and many years ago destroyed, and hence no means of comparison or correction of our standard now exists. It is composed of brass, a material which readily oxidizes. Its density is unknown, and its accuracy is distrusted by scientific men. But whether the brass

weight in the mint is accurate or not, the word pound is uncertain, ambiguous, and indefinite. It may mean 16 ounces when applied to iron, or 12 ounces when applied to silver or drugs. The pound avoirdupois is heavier and the ounce lighter than the pound and ounce troy. We have not the confusion existing a hundred years ago described by Dr. Mendenhall in his address on "Measurements of Precision," wherein he says:

At the close of the last century, in different parts of the world, the word pound was applied to 391 different units of weight and the word foot to 292 different units of length.

Nor have we the state of affairs described by Mr. Charles Read as existing in Shropshire, where they are said to have had different weights for different market days. We have, however, a delightful state of extreme uncertainty as to the correspondence of weights in different parts of the country, and no satisfactory standard of comparison and no method of enforcing uniformity. We have a complication of relations and a multiplicity of terms without inherent significance that must inevitably lead to confusion and uncertainty. The man who can tell the exact relation between the scruple, drachm, pennyweight, and grain is but little wiser than he who knows whether a hundredweight means 100 or 112 pounds and whether a ton is 2,000 or 2,240 pounds.

When we pass to measures of extension we strike a realm of scarcely less uncertainty and certainly of no less complication. The primary standard of length, the "three barleycorns, round, plump, and dry," which make an inch, proved but an indefinite guide. The soil, season, culture, and care of selection are all constructive elements of this standard, without uniformity and without possibility of accurate computation. For generations we had a scarcely more definite standard, and when in 1830 the Treasury Department gathered together those from the various custom-houses for comparison they were found to vary materially, and the one approaching nearest supposed accuracy was a folding yardstick in Philadelphia. If the official standards of the Government vary, what may we expect of the miscellaneous and cheap measures in the hands of the people? But assuming the exactness of the unit, what ingenuity of complication gives us $5\frac{1}{2}$ yards or $16\frac{1}{2}$ feet for a rod, $7\frac{9}{16}$ inches a link, 100 links a chain of 4 rods, and when you square these dimensions for the purpose of surface dimensions the "confusion confounded and the confounded confusion" is proportionately increased.

But the beauties of our system are most strikingly exemplified in our measures of capacity. The size of our quart, gallon, bushel, and barrel is elastic or adjustable, and depends on the commodity to be measured, the place where it is measured, and, formerly in Pennsylvania at least, the purpose and persons for whom measured. On the statute books of that State (1 Dallas Laws, p. 58) may be found an old law providing that all innkeepers "shall sell beer and ale by wine measure to all persons as drink it in their houses, and by beer measure to all persons as carry the same out of their houses." This is hardly more ridiculous in its inconsistency than the existing coinage laws of the United States, which measure the silver which goes into a dollar by grains troy and that which goes into the half dollar, quarter, and dime by grams of the metric system. Vermont, however, seems to have reached the climax of absurdity when she provides by comparatively recent legislation still in force, that in measuring certain specified commodities "one bushel and three-quarters of a peck shall be deemed a bushel."

These are but illustrations of the diversities and absurdities existing all over the country. The barrel of oil or cider in Pennsylvania, Ohio, and many of the States, according to legal provision, contains $31\frac{1}{2}$ gallons; but in actual fact it contains 40 or 42 gallons. The gallon of milk in New York contains 231 cubic inches, and in Minnesota it is fixed by law at 282. The usual bushels of different parts of the United States are stated by Professor Rennick to vary from 1,925 to 2,358.6 cubic inches, and Hon. J. K. Upton, in his report transmitted to Congress in 1878, says "the bushel for measuring products of the earth has 130 different sizes in this country, and none of them the size of the bushel of England, to which country most of our surplus products are shipped in quantities measured by bushels." The standard bushel used by the United States in the custom-houses and furnished as standard to the various States is 3 per cent smaller than the standard bushel of Great Britain, being the old Winchester bushel of 2,150.42 cubic inches, while the imperial bushel, the present standard of Great Britain, contains 2,218.192 cubic inches.

If we undertake to determine the bushel by weight instead of cubic contents the difficulty is not avoided nor the confusion lessened. The bushel of oats varies from 26 pounds in Maryland to 36 pounds in Oregon and Washington. The bushel of barley weighs 32 pounds in Louisiana and 50 in California. The laws of New York and Oregon make 42 pounds of buckwheat a bushel, while those of Minnesota and Nebraska call for 52 pounds, and Kentucky 56 pounds. The bushel of rye weighs 32 pounds in Louisville, but grows to 56 pounds in Ohio and most of the States. Potatoes weigh 50 pounds to the bushel in Washington, 56 in Pennsylvania, and 60 in Ohio and many of the other States.

In Maine 44 pounds make a bushel of apples, while 57 are required in Wisconsin. A bushel of salt weighs but 50 pounds in Virginia and several of the States, but reaches 70 in Massachusetts, and brings down the scales at 80 in Colorado.

The failure of Congress to establish standards has naturally led each State to do so for itself according to its own whim or caprice, and the diversity is nearly as great as prevailed in feudal times in Europe when each feudal chieftain thought the exercise of his proper functions of sovereignty required him to establish a distinctive system of his own.

ADVANTAGES OF THE METRIC SYSTEM.

The advantages of the proposed system are twofold:

First, it is international in character, and almost universally in use among civilized nations. It is the system of Europe, except in England, Russia, and Denmark, in which it is qualifiedly permissive; is in use in parts of Asia, in a considerable portion of Africa, in South America, in Central America, and Mexico. There is good reason for believing that Russia stands ready to join with England or the United States in its adoption, and when that is done the other nations must necessarily follow suit and the system become universal. The House of Commons has on different occasions approved measures making the system compulsory in Great Britain, but they have failed in the less progressive House of Lords. During the past year a committee of the House of Commons have been examining the subject with characteristic British patience, thoroughness, and comprehensiveness, and their report, unanimous except for a single dissenting vote, recommends that the metric system be at once legalized for all purposes, and that after the lapse of two years its use be rendered compulsory. This recommendation is

based on the complicated and unsatisfactory condition of their present weights and measures and the distrust and serious drawback to their commerce, especially their foreign trade, entailed by the existing system. We quote from the report:

They [the committee] have in the first place received evidence from witnesses representing many different interests: (1) official; (2) commercial; (3) manufacturing; (4) trade; (5) educational; (6) professional.

They have also received from numerous corporations, school boards, and other public bodies, resolutions without exception in favor of the adoption of the metrical system.

Your committee find that almost all the witnesses express a strong opinion as to the complicated and unsatisfactory condition of our present weights and measures, and of the distinct and serious drawback to our commerce, especially our foreign trade, which this system entails, differing as it does from the system (metrical) now adopted by every European nation except ourselves and Russia, as well as by far the majority of non-European countries with which this kingdom trades. The evidence, however, goes further to show that not only is our foreign trade in every branch seriously handicapped, but that the home trade would be benefited if more simple and uniform standards of weights and measures than those now existing were adopted.

Moreover, strong evidence was brought forward as to the serious loss of time incurred by English school children in having to learn the complicated system of tables of existing weights and measures, and the urgent need of the adoption of a simpler system. It was stated that no less than one year's school time would be saved if the metrical system were taught in place of that now in use.

Evidence from competent witnesses proved to the satisfaction of your committee that a compulsory change from an old and complicated system to the metrical had taken place in Germany, Norway and Sweden, Switzerland, Italy, and many other European countries, without serious opposition or inconvenience; That this change was carried out in a comparatively short period, and that as soon as the simple character of the new system was understood, it was appreciated by all classes of the population, and no attempt to use the old units or to return to the old system was made.

The recent reply of Mr. Balfour to the deputation of the English Chamber of Commerce urging on him the pressing need of the speedy adoption of the metric system, while hesitating to commit himself or the Government to the exact programme marked out by the committee of Parliament, indicates no dissent as to the desirability of the change. He said:

Upon the merits of the case I think there can be no doubt whatever that the judgment of the whole civilized world, not excluding countries which still adhere to the antiquated systems under which we suffer, has long decided that the metric system is the only rational system. * * * What men of science have long been obliged to do—not merely because the international character of science makes it desirable, but also because the calculations are so much more rapid, so much more convenient—what men of science for these reasons are obliged to do, I believe that commercial firms in all parts of the country are beginning to think they must do also. On that point I do not think argument is possible.

The witnesses examined before the committee of Parliament were of the highest character and best qualified to judge intelligently of the matter on which they were examined. Their testimony fully justified the conclusion reached by the committee. It demonstrated that British manufacturers were daily losing to manufacturers and merchants of metric-using nations orders from other metric nations which they would otherwise have had—in other words, that metric nations preferred to purchase of nations using a system that was intelligible to them.

Accompanying the testimony taken by the committee are extracts from reports of British consuls from eighteen different and important points in different parts of the world. Everyone reports that in their opinion the adoption of the metric system by Great Britain would greatly promote her commerce with those countries, and that the fact of her not having that system was exercising a repressive effect on her commercial intercourse with those several nations. Facts are given

and specific instances cited, and no part of the testimony is more impressive than this collation of extracts from consular reports, all concurring, from widely separated points of observation, in the same conclusion. There can be no possible doubt of these facts, and the United States, in its commerce, is to-day seriously suffering from the same cause. Attention is asked in this connection to the opinion of the Chief of the Bureau of American Republics, whose duties place him in a position to speak with abundant information and authority on this subject. Why should the United States alone of all the republics of the Western Continent persist in its adherence to a cumbrous and antiquated system, if it may be called a system, of weights and measures, and thus let much of the commerce of its sister republics which it should attract and enjoy drift to the metric-using nations of Europe?

We are out of touch with all the nations of the world commercially except Russia, with which our commerce is small, and England. The articles we sell England are mainly grain, sold by the bushel, and our bushel differs from the English bushel; petroleum, sold by the gallon, and our gallon differs from the English gallon; and cotton, sold by the pound, and our pound corresponds with the English pound. Almost our entire commerce with the world then requires to be translated or converted from the terms of our weights and measures into those of the various countries with which we trade. According to the statement of the Chief of the Bureau of Statistics of the Treasury Department, the commerce of the United States with other nations, classified according to the system of weights and measures in use, is as follows:

	Population.	Imports.	Exports.	Total imports and exports.
Total obligatory metric system.....	254,318,820	344,270,432	277,224,066	621,494,498
Total legalized.....	3,476,000	2,709,922	1,272,089	3,982,011
Total permissive.....	83,686,518	191,659,728	399,961,407	591,621,135
Total nonmetric.....	118,155,901	12,626,393	15,283,403	27,909,796

In this classification the commerce of the United Kingdom embraces practically all that claimed as permissive except Japan, which has a characteristically oriental system, mixed in use with the metric system, which is gradually replacing the former. Turkey is also classed as permissive, because the law, while obligatory in measurement of cereals and use of weights, is not enforced. Russia and Denmark are classed as nonmetric, although the metric system has been introduced in Finland, an important part of Russia, and by royal decree of January 13, 1895, pharmacists and medical men throughout the Empire are compelled to use the metrical system alone in preparing and dispensing their medicines. In Denmark the metric system is permitted and largely used, as is natural, that country being surrounded by metric-using nations. In Guatemala, Nicaragua, Honduras, and Salvador the respective Governments have formally promulgated the metric system of weights and measures and all official transactions are based upon it.

The population of the metric-using nations, according to the list submitted by Mr. Dowson to the English committee aggregated 445,296,003. It practically includes the civilized world except Great Britain, Russia, and the United States. Our commerce with Russia is not great, and we have with her no common system of weights and measures to be disarranged by the adoption of a new system. With England we can hardly be said to have a common system with our quart and gallon 17

per cent less than hers, our bushel 3 per cent less, and her hundred-weight and ton exceeding ours by 12 per cent. We have the same terms, but these terms have not the same meaning, and the confusion is perhaps greater than if the terms were distinct. We can change the English quart, gallon, or bushel to terms of the liter as easily as to our quarts, gallons, or bushels. In every way and with every nation on the globe our foreign commerce would be simplified and unhampered of embarrassing and impeding conditions and limitations by the adoption of the metric system.

How much loss of time and productive energy is entailed by this variation of systems is difficult to estimate, but it is by no means small. Mr. H. G. Wollmer, member of a leading firm dealing in textile and other goods, testified before the committee of the British House of Commons that his firm alone employed in converting the weights and measures of goods sold from one system to another "four or five men whose work could be saved if the metric system were in use," and other witnesses gave corroborating testimony. Following up the investigation along this line, it will be found that in the vast volume of international trade the translation from the terms of one system to another must require an immense amount of labor, and this labor is all "lost power," wasted and needlessly wasted energy and effort.

We provide by statute that all invoices of imported goods shall be in the terms of the system of the country from which the goods are shipped. Duties, however, are imposed in terms of our own system. The labor, then, of conversion from one system to another falls on the customs officers of this country. The conversion for the purposes of use and sale falls on the purchaser, and thus we are subjected to the loss of time involved in a double conversion for both governmental and business purposes. Both would be saved if a universal system were in force.

Secondly, the metric system, from its decimal character, is convenient and economical in practical use. To a nation that appreciates so fully the beauties and advantages of the decimal system in its coinage and currency no argument or demonstration of the wisdom of transforming its weights and measures into a decimal system would seem necessary. The saving of time in the schoolboy's life that would result from the change has been estimated with considerable unanimity by educators, but the saving in all the practical operations of subsequent everyday life is beyond the possibility of intelligent estimate. The report of the committee of the English Parliament states that "no less than one year's school time would be saved if the metrical system were taught in place of that now in use." This is corroborated by the estimates of educators in this country, some of whom concur in the English estimate of an entire year in the child's school life, and others limit it to the saving of a year in the time given to arithmetical instruction. Taking it on either basis and remembering that there were in 1894, according to the report of the Commissioner of Education, in the public and private schools of this country 15,327,210 school children, and the aggregate loss is appalling. Fifteen million years of human life wasted and needlessly wasted! Who will assume the responsibility for the continuance of a system producing such results?

How much time is wasted in the practical affairs of mature life in the complicated computations inevitably incident to our existing system that might be saved if the simpler decimal system were in use no man can estimate with even approximate accuracy. Contrasted examples of the amount of labor in similar operations under the two systems can

be readily given and easily comprehended, but the grand aggregate of needlessly expended mental effort growing out of the numberless computations of daily life admits of no estimate that would be more than guesswork. Every man who will think can see that the loss is great—no one can say how great.

Beyond the adaptation of the metric system to the economic transactions of the common affairs of daily life, it has a claim to respectful consideration as being the language of science the world over, used in scientific investigation and understood by scientific men in every nation and clime. Its use tends to accuracy and precision of thought and expression as well as universality of comprehension. Under it the terms in which the physician administers his medicines are no longer an unsolved enigma. The goldsmith no longer describes the weights of his goods in terms of which we have but misty comprehension. The relations of things in size and weight are more clearly comprehended. The simplicity of the system, its "oneness," to use the word coined by Lord Kelvin, is one of its great merits. It has but one system for every kind of weight and measure, and the method of written expression is the one of ordinary numerical notation. The fundamental unit is the meter, and from that are derived by the simplest process not only measurements of extension, but of weight and capacity as well. The conversion of bulk to weight and weight to bulk requires but a knowledge of specific gravity. The symmetry and completeness of the system are unquestioned and unrivaled.

OBJECTIONS TO THE METRIC SYSTEM.

What reason is there for carrying longer the burden of a system so wearying in its operation, so wasteful in its effects? Objection is made to the accuracy of the method by which the length of the meter was originally determined. This work was done by the most eminent scientists of their day under the patronage and with the approbation of several great nations. Their work is thus alluded to by Adams in his report:

The spectacle is at once so rare and so sublime, in which the genius, the science, and the skill and the power of great confederated nations are seen joining hand in hand in the true spirit of fraternal equality, arriving in concert at one destined stage of improvement in the condition of human kind, that not to pause for a moment, were it even from occupations not essentially connected with it, to enjoy the contemplation of a scene so honorable to the character and capacities of our species, would argue a want of sensibility to appreciate its worth. This scene formed an epoch in the history of man. It was an example and an admonition to the legislators of every nation, and of all aftertimes.

The work occupied seven years and probably attained as great a degree of accuracy as is possible for human effort. It certainly is as accurate as a standard derived from the varying size of the grains of barley, or the uncertain length of a dead king's foot, or the extension of a king's arm. But what matters the accuracy of the original determination? There exist now on the only piece of land in the wide world whose entire neutrality is absolutely assured complete standards, of material and workmanship as perfect as it is possible for human skill to attain. They are guarded and their safety assured by the alliance of twenty-two of the great nations of the world. As a precaution against loss and for national use, each of these nations has a perfect prototype copy of the original standards, of similar material and workmanship, accurate to the minutest fraction of a hair. There is no longer the possibility of the loss of the standard or of a variation from it that is incapable of correction. It may be noted, however, as a mat-

ter of scientific interest, that in addition to the other methods of reproducing the standard meter should it be necessary, it has lately been measured in lengths of waves of rays of light. This achievement is the triumph of American science and American skill, the work having been done by Professor Michelson, of Chicago, with instruments manufactured by Mr. Brashear, of Allegheny, Pa.

It is said that the words and terms of the metric system are foreign and too long for convenient use. To the scholar they have an acceptability and precision of meaning not apparent to others. Each one is a definition in itself. To the name of the original unit are added prefixes of Latin or Greek derivation that accurately indicate the value of each term. The average American would undoubtedly prefer shorter names of purer Anglo-Saxon. These terms, however, are not simply for American use, they are for all nations. They are taken from the language of no existing people, but from the classic languages of antiquity, the common inheritance of all nations. They have been readily assimilated to the languages of other nations adopting the system, and accepted into their daily life. Americans are not less quick of wit or ready of adaptation or facile of tongue than other peoples. The terms necessarily used are but few; many of those appearing in the tables would be of use only in exceptional instances, no more than the eagle or the mill are used in the actual application to daily life of our money tables. If abbreviations are necessary, or if arbitrary symbols shall seem desirable, Yankee wit and ingenuity can be relied on to supply the want.

The principal obstacle, however, in the way of the introduction of the proposed system lies in the attachment of the people to familiar terms, processes, and things. They have a definite idea what a pound or a yard means; they have a very indefinite or perhaps no idea of what a kilogram or a meter means, and they fear they will never understand. They are accustomed to the ordinary division into halves and again into quarters; they understand the movement by tens and tenths in numeration and notation, but they are a little dazed by what they suppose its necessary application to all operations of measurement or weight. In practical life they will undoubtedly use the half kilogram approximating the pound, the half liter approximating the pint, and the half meter approximating the half yard, and very likely the quarters of each, as we do the half and quarter dollars. This is a matter of convenience in daily life. It does not detract from the use or convenience of the decimal system in all computations and all operations expressed in visible figures. The foot varies but a trifle from three-tenths of a meter or 3 decimeters, and will undoubtedly long remain in actual use slightly modified to correspond exactly to 3 decimeters. We will speak of it as a foot but write and compute it as 0.3 of a meter, just as we speak of half a dollar and write it 0.5 of a dollar. So half a kilogram may pass in common parlance as a pound but be written and computed as 0.5 of a kilogram. Half a liter may be called a pint but be written and computed as 0.5 of a liter.

Gradually and imperceptibly these designations will fade away as the generation into whose life they have been so thoroughly inwrought fades away, as was the case in Germany and has been the case with our currency system here. Our fathers adhered to the use of their diverse shillings, differing in value in almost every State, but it gradually became in each State a local custom not affecting the general symmetry or general national use of our decimal system, and gradually faded out of use altogether.

The ease with which other nations, except France, where vacillating legislation and revolutionary disorders impeded the work, have made the change of systems has been surprising. Germany changed to the compulsory system in two years, Austria in three, and without friction or trouble. Merchants displayed the new weights and measures in advance, curiosity fixed them in the minds of the people, pride in displaying their ability to grasp the use of them led people to call for commodities in their new terms in advance of the prescribed time, and when the time came to make the change it was already made. The evidence on this point before the English Parliamentary committee was instructive and surprising. It indicates the wonderful difference between the theoretical teaching of the books as to a system not in actual use and the instruction and enlightenment of the object lesson of the sight and use of the actual, visible, tangible thing. The optimistic view of adoption is expressed by Lord Kelvin, the eminent English scholar and scientist, in his testimony before the English committee, wherein he says:

I believe that the difficulty of making the change has been enormously exaggerated. I believe that in a fortnight people would become so accustomed to the perfect simplicity and easy working under the metrical system that they will feel that instead of its being a labor to pass from one system to the other, it will be less than no labor—that is to say, it would be a very great saving of labor after the first day or two of beginning to use the metrical system.

And yet the testimony of actual experience nearly confirms his opinion. Mr. Siemens, the noted engineer, testifying as to its introduction into his own works, says: "It was all a matter of about a fortnight or three weeks; then the people were accustomed to it and did not ask any more for the old measures, but asked for the new," and speaking of his observation of its general introduction into Germany, he said:

Q. Did I understand you aright, that it was about four years during which the transition took place? The act was passed in 1868, and it was made absolutely compulsory in 1872, was it?—A. Yes.

Q. And there was really not anything that you may fairly call friction or national opposition on the part of the masses of the people?—A. No, not at all; in fact, as far as I recollect it, the metrical system was very largely adopted between the 1st of January, 1870, and the 1st of January, 1872, during the optional period. It was very largely adopted then, and was found to work so well that when the compulsory time came there was nobody to be compelled.

Captain Sankey, after explaining the practical advantages of the system in his extensive boiler and steam-engine manufactory, testified, in answer to questions as to its introduction, as follows:

Q. Have you found any difficulty with your workmen in that respect?—A. Absolutely none.

Q. Do they adopt it and see the advantages of the system?—A. I should say so. In fact, in connection with my coming here this afternoon, I asked four or five of our men privately (not through the works' manager) what they thought of it, and there was not a dissentient voice among them. They all agreed at once that the millimeters were very much easier to work to than the English measurements.

Q. I understand you found your men had not the slightest difficulty in adapting themselves almost immediately to the new system?—A. Not after the first few days. I asked that very question of the head of our tool room, and he said it was a little awkward for a time. I said, "About how long?" and he said "Two days."

Mr. H. E. Wollmer, of the great mercantile firm of Sir Jacob Behrens & Sons, corroborated the observation of Mr. Siemens as to the ease of its introduction into Germany, as follows:

In Germany I noticed when the change was being made everybody became a teacher; the schoolmaster was a teacher, the shopkeeper was a teacher, and everybody had this very thing in view; the schoolmaster, the trader, the children, and everybody. It became a practical question. They knew they had to be ready when the time came, and they were ready before the time came.

To the same effect is the testimony of Mr. Rowlett, the Leicester merchant:

Q. You had dealings with Germany about the time of its adoption?—A. I had.

Q. And, as far as you understand, its adoption was accomplished with, comparatively speaking, ease?—A. Certainly. I have always understood them as speaking of it as having gone through with scarcely any friction.

Even the Arabs and Africans had no trouble with it, as shown by the testimony of Mr. Pilter, of the British Chamber of Commerce:

I have property in Tunis, and I am obliged to spend a certain part of my time there each year. The people of that country, the Arabs and the negroes, have had introduced among them quite lately the decimal system of coinage, the French system; and within the last few months, perhaps eight months, the metric system of weights and measures has been introduced, and they grasp it easily and without difficulty. They had before then a system of 12 saas to the ouiba, and 16 ouibas to the caffis; but they have learned the liters and the meters very easily.

That the testimony above cited was a fair statement of the experience of Germany, and that Austria's had been similar, was disputed by no one, not even by Mr. James Stevenson, the strenuous opponent on the committee of the introduction of the system into England. The ease and readiness with which the Germans and Austrians made the change is beyond possible dispute or question.

What man has done man can do. What the German, the Austrian, even the Arab and the African have so easily done ought not to frighten or deter the American. We can not admit ourselves less quick of wit, intelligent of comprehension, or capable of action than they. Beyond that we have advantages which they did not enjoy. We are familiar with the practical operation of the decimal system in our currency system, which they were not. A considerable element of our population is made up of immigrants from metric-using nations, who have brought here a practical familiarity with the system. Our children have been taught the principles of it in our public schools with more or less thoroughness. It is already used in pharmacy and in scientific work and investigation. And more than all by previous legislation making its use permissive and legal, by the furnishing of its standards to the various States, by its recognition by formal order of the Treasury Department, by its permissive but limited use in the Post-Office Department, and in certain bureaus of other Departments, by its exclusive adoption in electric measurements—in all these and other ways the way has been paved for the general adoption of the system to an extent previously done in no other nation. Hence the transition in this country should be materially easier than in any other nation that has made it.

Your committee are not blind to the fact that considerable temporary inconvenience will accompany the change, but they believe that this is greatly overestimated and that it will be of short duration. This belief is founded on the experience of other nations less agile and versatile of intellect than we are, but whether the inconvenience be little or great it must sometime be encountered, and it will not be decreased by the increase of our population. It will be no easier for a hundred millions of people ten years hence to make the change than for seventy millions to-day. It is simply a question whether this generation shall accept the annoyance and inconvenience of the change largely for the benefit of the next, or shall we selfishly consult only our own ease and impose on our children the double burden of learning and then discarding the present "brain-wasting system." The present generation must meet this test of selfishness or unselfishness, and answer to posterity for duty performed or neglected. The neglect of our fathers can not

justify us. They delayed for a greater light and a clearer way. Passing years have brought the light, and action of other nations has cleared the way.

NATIONAL HONOR.

A nation ordinarily progressive can not longer afford to linger in the rear of this great movement. A position of isolation is not consistent with American capacity or American destiny. Her sister American republics have appealed to this country to unite with them in this great reform. Her great Secretary of State joined in this appeal. Successive Secretaries of the Treasury, including the present head of that Department, have formally recommended it. Other eminent citizens, many representatives of a great commercial interest, the prevailing sentiment among her educators, the practically unanimous voice of her scientific men ask for this legislation. By formal memorial the governor and legislature of a sovereign State join in this appeal. The experience of other nations confirms the belief in its wisdom. The commercial interests of our people, the economy of time, the saving of effort, even national honor demands action on this subject.

The signature of our duly accredited representative leads the signatures to the compact of 1875, creating an agency "to discuss and initiate measures necessary for the dissemination and improvement of the metric system," and since then she has been one of the largest contributors and most prominent actors in the work of guarding and testing the international metric standards and of constructing and distributing prototype copies of the same to other nations. On what theory are we thus zealously engaged in the "dissemination" of the metric system except that its universal use is desirable; and if desirable for the other nations, why not for the United States? "With what measure ye mete, it shall be measured to you again."

In 1888 (by resolution of May 24) this country invited the republics of Central and South America, Mexico, Haiti, and San Domingo to a conference to be held in the city of Washington to consider among other things "the adoption of a uniform system of weights and measures." The invitation was accepted; the conference was held. To the extent of its power it adopted a uniform system of weights and measures. The other nations, parties to the conference, with scarcely an exception have honorably proceeded to put in force in their respective limits the metric system thus adopted. On what principle of international honor can the United States, the originator of the conference, stand alone in refusing or delaying to abide by its action? What possible motive can this country have in thus coquetting longer on this subject with the nations of Europe and her sister republics? Having sought the verdict of a tribunal of our own choosing shall we fail to stand by its decision? A nice sense of honor no less than her own interests would seem to demand from the United States definite and complete action which should put her in full accord on this subject with the nations with which she has so long ostensibly been cooperating.

COMMITTEE'S INVESTIGATION.

Your committee in the investigation of this subject have not only heard such gentlemen as saw fit to come before them, but they sought the views of officers of the Government whose work would be most directly affected by the proposed change. They have examined the facts submitted to former committees of this House, and have availed them-

selves of the testimony lately taken before the committee of the House of Commons of England in their investigation of this subject extending over several months. They have sought to learn by letters of inquiry to the superintendent of public instruction of each of the States, as well as the Commissioner of Education of the United States, the extent to which instruction is now afforded in the metric system in the various States. The replies indicate that this instruction varies much as the educational progress of the States varies. Utah has placed in her constitution a provision requiring such instruction in all the public schools. In all the States the instruction is largely abstract and theoretical, and necessarily so, but the moment the system goes into practical operation or it becomes certain that it is to go into operation at no very distant date, the character of the instruction will at once change and become practical in character. The English school authorities are already furnishing to schools asking for them actual specimens of the liter, meter, etc., and a similar course by the school authorities of this country would be wise.

CONCLUSIONS.

Your committee, after a careful consideration of this subject, have unanimously reached the conclusion that the metric system of weights and measures should be put into exclusive use in the various Departments of the Government at such future date as shall allow adequate preparation for the change, and at the end of a fixed time thereafter that said system shall be recognized as the only legal system for general use. They, however, do not deem it wise at present to require a change in the methods of surveying the public lands, as this would in that respect destroy rather than promote uniformity.

Your committee also deem it prudent to enlarge the time for the proposed system to take effect to a date somewhat later than the date proposed in the bill submitted, adopting for this country about the average time deemed necessary by other nations. Your committee, therefore, recommend that the time for adoption in the Departments and operations of the Government, except in the completion of the survey of the public lands, be fixed for July 1, 1898, and that the adoption of the metric system for use in the nation at large be fixed as coincident with the dawn of the twentieth century, and that date be accordingly changed to January 1, 1901, the first day of the new century.

Your committee also deem some changes in phraseology desirable in the proposed law to avoid ambiguity and uncertainty. To most clearly and intelligently express those proposed changes and the scope of the bill after they are made, your committee have embodied them in a substitute bill which they report herewith and respectfully recommend that it do pass.